Issued July 31, 1915.

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF SOILS—MILTON WHITNEY, Chief.

SOIL SURVEY OF THE FORT LAUDERDALE AREA, FLORIDA.

BY

MARK BALDWIN AND H. W. HAWKER.

CHEMICAL WORK BY CARL F. MILLER.

W. EDWARD HEARN, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1915.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1915.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., May 22, 1915.

SIR: In the extension of the soil survey in the State of Florida, work was undertaken in the Fort Lauderdale area and completed during the field season of 1915.

The accompanying report and map cover this survey and are submitted for publication as advance sheets of Field Operations of the Bureau of Soils for 1915, as authorized by law.

Respectfully

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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Soil map, Fort Lauderdale sheet, Florida.

SOIL SURVEY OF THE FORT LAUDERDALE AREA, FLORIDA.

By MARK BALDWIN and H. W. HAWKER.

DESCRIPTION OF THE AREA.

The Fort Lauderdale area, Florida, comprises a relatively narrow strip of territory extending from the Atlantic Ocean east of Fort Lauderdale to Lake Okechobee. In general it follows the course of the North New River Canal from New River Inlet to its upper end at the extreme southern point of South Bay. Beginning at the ocean and extending inland for about 12 miles, the north and south limits of the area are east-west lines 6 miles apart, coincident with the boundary lines of township 50 south. The survey thus includes all of township 50 in ranges 41 and 42 east of the Tallahassee meridian. Northwestward from near the eastern line of range 40 the area to within 12 miles of Lake Okechobee consists of a 5-mile strip, bounded by lines $2\frac{1}{2}$ miles from the canal on each side and parallel to it. Between Lake Okechobee and the 12-mile post on the canal the survey embraces a 7-mile strip, the parallel boundary lines being 3 miles from the canal on each side.

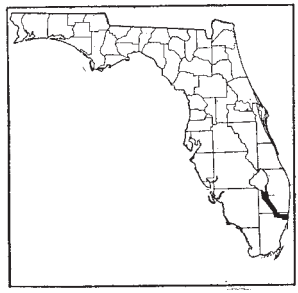


FIG. 1.—Sketch map showing location of Fort Lauderdale area, Florida.

Portions of two counties—Dade on the south and Palm Beach on the north—are included in the territory surveyed.

This area lies between parallels of latitude 26° and 26° 45′ N. and meridians of longitude 80° 5′ and 80° 50′ W. Its extreme length from the ocean to the shore of Lake Okechobee is 63 miles; its width is 5 to 7 miles; the total area is 352.5 square miles, or 225,600 acres.

The base map covering the area was compiled from a planetable traverse, made as the soil mapping progressed, from charts of the Coast and Geodetic Survey, and from a map of Lake Okechobee published by the United States Geological Survey. The map as finally completed shows the location of towns, houses, schoolhouses, and churches, roads and railroads, the largest bodies of water, streams and canals. The boundaries of the various soil types and phases

encountered in the survey are indicated, and each area of soil is identified by color and symbol.

The general topographic features of the Fort Lauderdale area are those of a vast flat plain, gently sloping toward the east and southeast. From the shores of the lake, where the elevation is about 21 feet above sea level, there is a gradual fall averaging 0.2 to 0.3 foot per mile to the eastern edge of the Everglades, 3 to 4 miles west of Fort Lauderdale, where the elevation is about 4 to 6 feet above sea level. The eastern half of this part of the area is very gently undulating or hummocky, owing to a series of ridges and sloughs with local differences of 2 or 3 feet in elevation, having a general northwest-southeast direction. Immediately east of the Everglades is a slightly elevated ridge of level to undulating topography, the maximum elevation of which is about 15 feet. This ridge consisting of limestone rock and unconsolidated sand is commonly known as the rock rim, and its continuous north-south trend through the area is broken only by the channel of New River. East of the rock rim is a depression 1 to 2 miles wide, portions of which are covered with salt water, permanently or periodically, the remainder being only slightly above sea level. Between this depression and the ocean is a ridge of loose sand attaining an elevation of perhaps 12 feet above sea level.

The natural drainage conditions of the Fort Lauderdale area are quite variable. The higher portions of the beach ridge and the rock region are well drained, and in the looser sands the drainage is excessive. The depression between the beach ridge and the rock rim is so low and flat that artificial drainage is everywhere necessary for agricultural operations, and much of it, being subject to tidal overflow, can not be rendered fit for cultivation except by diking and pumping.

The natural drainage of the Everglades followed the general southeastward slope through the sloughs which trend in that direction and found outlet to the ocean through a few breaks in the rock rim. This natural drainage system is and has been entirely inadequate to carry off the rainfall and the overflow from Lake Okechobee. These poor drainage conditions existed over the entire area of the Everglades surveyed, with the exception of one extremely narrow higher rim bordering Lake Okechobee.

The natural drainage has within recent years been supplemented by the construction of artificial drainage ways, involving the digging of large canals and the construction of subsidiary canals and small lateral ditches. One of these main canals, the North New River Canal, is the chief drainage feature of the area considered in this report. (See Pl. I.)

The drainage of the Everglades has proceeded sufficiently to induce noticeable changes in the character of the vegetation in certain

places. In the interior of the glades, along edges of the sloughs which once supported a luxuriant growth of water lilies the lowering of the water table is accompanied by the invasion of saw grass and *Sagittaria* on the lower ground. Two or three miles south of the lake willows are gradually encroaching upon ground which under former conditions of poorer drainage supported a heavy growth of saw grass. In the "lower glades" saw grass is giving way to myrtle, maiden cane, and fennel.

The appended map (Pl. A) indicates the level of the water table in the Everglades as it existed at the time of the survey, January 22, 1915, to March 16, 1915. This is normally the dry season of the year. The boundaries between the flooded areas and the areas where the water table was below the surface were drawn in between points of observation.

In the "lower glades," the eastern portion of the Everglade section, there are numerous small islands covered with a growth of cypress and myrtle which are sufficiently high to be free from standing water at most times. These areas, however, because of their small size, are not indicated on the accompanying water table map. No attempt is made to illustrate the water conditions east of the Everglades.

According to the best information obtainable, there were three families living on the site of Fort Lauderdale in 1896. During this year the Florida East Coast Railway was completed from West Palm Beach to Miami, but settlement was slow until about 1910, at which time Fort Lauderdale was a village of about 200 inhabitants. The prospective completion of the draining of the Everglades brought many people here from all parts of the United States, principally from the North and Northwest. This influx of settlers was most rapid between 1910 and 1915. It is estimated that at present there are 3,000 people in Fort Lauderdale and the immediate vicinity. Dania, the second largest town in the area, has a population of about 600. A settlement in the vicinity of Dania, situated about 7½ miles southwest of Fort Lauderdale, in the eastern edge of the Everglades, consists of about 250 people. A few families have settled between Fort Lauderdale and the locks on the North New River Canal. For a distance of more than 45 miles above the locks no permanent homes have been established.

In the vicinity of the intersection of the cross canal and the North New River Canal, 4¼ miles south of Lake Okechobee, a number of people have settled. A few settlers and "squatters" have established homes on the rim of the lake.

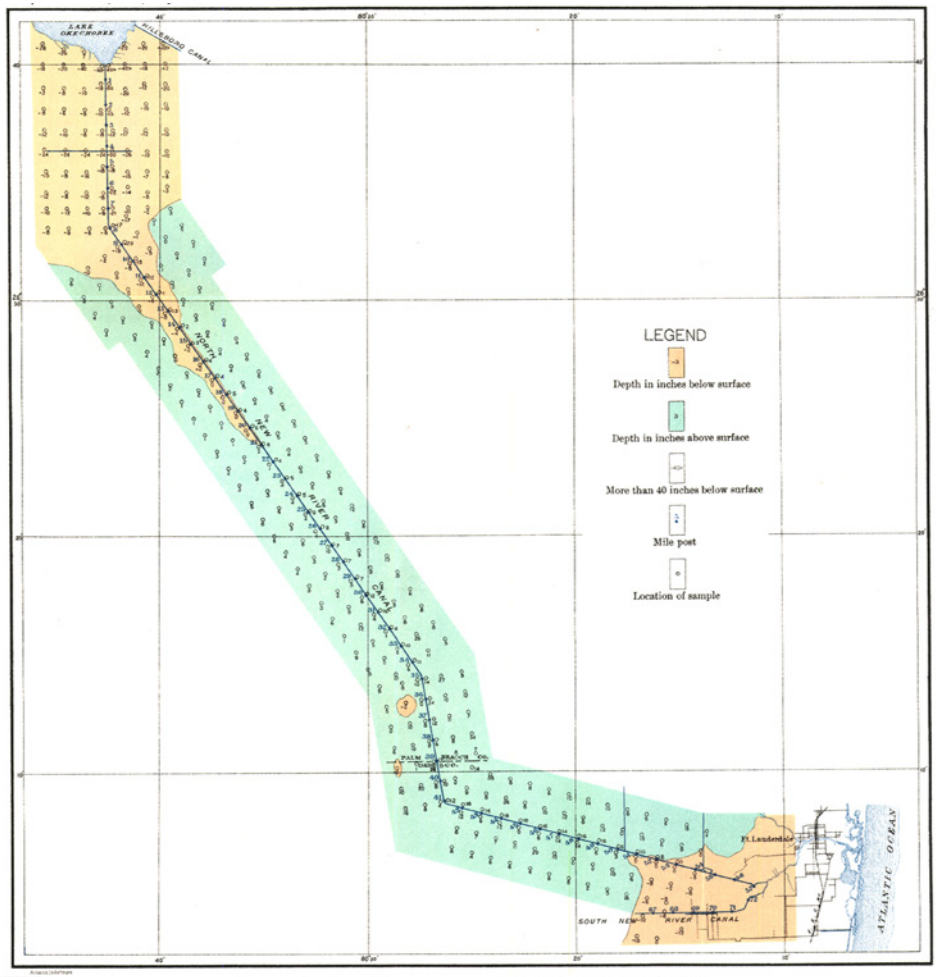
The transportation throughout the Everglades portion of this area is by boat on the North New River Canal and its tributaries. This

canal is at present navigable for shallow-draft boats and barges, which are used for the transportation of passengers and freight. It is contemplated that other cross canals, navigable for small boats, shall be constructed, but there are no roads through the Everglades and areas remote from existing canals have no transportation facilities. Other parts of the area are supplied with water transportation by Lake Okechobee, the South New River Canal, New River, and the East Coast Inland Waterway Channel. The Florida East Coast Railway, completed to Key West in 1912, crosses the eastern end of the area, with stations at Fort Lauderdale and Dania. Through express trains are operated during the trucking season to provide for the shipment of perishable vegetables which must reach the northern markets promptly.

In the vicinity of Fort Lauderdale and Dania the main highways have been surfaced with limestone rock procured from pits in the underlying formation. Excellent roads are thus made and maintained at a comparatively reasonable cost. The unimproved secondary roads through the pine woods are quite sandy and heavy in most cases.

Fort Lauderdale and Dania are the shipping points in the area. There is no way of reaching the market from the Everglades portion of this survey except by canal. Fort Lauderdale is one of the most important shipping points for truck on the east coast of Florida. From 300 to 1,000 crates of vegetables are shipped daily by express during the height of the trucking season, in addition to which 400 to 700 carloads are annually shipped by freight. The shipments from Dania are almost equal to those from Fort Lauderdale. The chief northern markets are New York, Philadelphia, Baltimore, Boston, Pittsburgh, Chicago, Kansas City, St. Louis, and Cincinnati, all of which receive carload shipments. Markets receiving smaller shipments are Buffalo, Milwaukee, Cleveland, Indianapolis, and other northern cities. The car-lot shipments go forward in combined ventilator and refrigerator cars, only a small percentage being under refrigeration. Many of the smaller shipments to northern markets and southern cities are by express.

Most of the truck crop is sold f. o. b. on docks or at railway stations to buyers who come into the territory and remain throughout the shipping season. The remainder of the truck is consigned to commission men in various cities of the North, Northeast, and Northwest, and a small quantity to the larger southern cities.



POSITION OF WATER TABLE AS DETERMINED DURING THE PERIOD FROM JANUARY 22 TO MARCH 16, 1915.

CLIMATE.

The climate of the Fort Lauderdale area shows considerable local variation. The records of the Weather Bureau stations within the area cover a period of only about two years, which is not long enough to establish dependable means of temperature and rainfall. The tables compiled from records at Miami and Jupiter, while covering a sufficient period of time to be of value, are not entirely applicable, especially through that portion of the area which lies in the interior of the Everglades. These tables, however, are appended for their general value as being the nearest stations where complete data are obtainable. The Miami records cover a period of 12 years, and the Jupiter records 23 years.

Normal monthly, seasonal, and annual temperature and precipitation at Miami, Fla.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	°F.	°F.	°F.	*Inches.*	*Inches.*	*Inches.*
December	68.7	91	32	2.23	1.19	0.27
January	65.7	85	29	3.27	1.48	4.60
February	67.8	88	29	2.49	.16	2.90
Winter	67.4			7.99	2.83	7.77
March	72.3	92	39	2.82	.72	4.80
April	74.0	92	46	3.07	.73	4.20
May	78.5	94	52	5.91	3.41	7.60
Spring	74.9			11.80	4.86	16.60
June	80.9	94	61	7.94	8.47	14.30
July	82.2	96	69	7.22	3.78	9.40
August	82.4	95	60	7.32	3.60	9.40
Summer	81.8			22.48	15.85	33.10
September	81.4	95	62	9.88	3.76	25.10
October	77.4	93	54	9.17	2.77	6.10
November	73.2	88	38	2.43	3.08	.40
Fall	77.3			21.48	9.61	31.60
Year	75.4	96	29	63.75	33.15	89.07

Normal monthly, seasonal, and annual temperature and precipitation at Jupiter, Fla.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	°F.	°F.	°F.	*Inches.*	*Inches.*	*Inches.*
December	66.3	86	24	2.83	2.56	1.96
January	64.3	83	24	3.50	.36	5.20
February	66.3	87	27	2.79	.95	5.14
Winter	65.6	.....	.....	9.12	3.87	12.30
March	69.4	89	33	3.01	3.26	3.65
April	72.2	90	39	2.40	1.90	8.47
May	76.4	93	53	4.86	1.15	10.73
Spring	72.7	.....	.....	10.27	6.31	22.85
June	79.6	95	64	6.90	.12	4.67
July	81.0	96	68	5.29	6.80	5.89
August	81.5	95	68	5.69	6.62	6.85
Summer	80.7	.....	.....	17.88	13.54	17.41
September	80.6	93	61	9.36	3.38	18.09
October	76.8	94	48	10.00	10.89	9.93
November	71.6	87	42	3.19	1.11	6.49
Fall	76.3	.....	.....	22.55	15.38	34.51
Year	73.8	96	24	59.82	39.10	87.07

The figures for Miami are most nearly applicable to the conditions in the Fort Lauderdale area in the neighborhood of Fort Lauderdale. Long, warm summers and short, very mild winters are typical of this section of Florida. Extremes of heat and cold are rare, owing to the tempering influence of the Atlantic Ocean. This influence on the weather conditions is, of course, most apparent near the coast. Farther inland the extremes are more marked. At Davie, which is 8 miles from the ocean, the minimum monthly temperatures range from 4° to 8° lower, and the corresponding maximum temperatures are slightly higher. These variations, however, are not entirely due to difference in geographical location, but partly to difference in topography, soil, and vegetation. Near Lake Okechobee the temperature is more equable, but somewhat cooler, than at Fort Lauderdale. According to local information no less than 12 frosts occurred in the neighborhood of the cross canal, 4 miles south of Lake Okechobee, during the winter of 1914–15. The first frost in this locality occurred during the latter part of November, 1914, and the last on the night of April 4, 1915. Frosts were less frequent in the immediate vicinity of Fort Lauderdale and on the shores of the lake.

The normal annual rainfall for this section of Florida is about 60 inches, subject to marked local and seasonal variations. In general the winter is considered the dry season and the summer the wet season. Normally, two-thirds of the rainfall occurs during the six months from May to October, inclusive. The rains are frequently torrential and 4 or 5 inches of water may fall within a few hours. It is believed that the rainfall during the fall and early winter of 1914–15 was greater than normal.

The following table gives the mean, highest, and lowest temperatures and the total precipitation at Fort Lauderdale, Ritta, and Davie, by months, from January, 1914, to February, 1915:

Temperature and rainfall at stations within or near the Fort Lauderdale area.

Month.	Fort Lauderdale.				Ritta.				Davie (Zone).			
	Precipitation.	Temperature.			Precipitation.	Temperature.			Precipitation.	Temperature.		
		Mean.	High.	Low.		Mean.	High.	Low.		Mean.	High.	Low.
1914.												
January	2.84	64.7	88	43	1.10	62.4	84	38	2.54	63.3	87	36
February	3.04	68.0	88	41	.57	67.4	85	45	3.94	67.6	89	36
March	1.47	65.4	84	34	1.44	63.8	88	34	1.49	63.8	86	27
April	10.51	74.8	87	56	5.03	73.2	94	56	7.61	73.2	92	49
May	3.07	77.7	92	62	.75	76.4	92	58	2.45	75.1	93	53
June	2.45	79.8	93	66	1.94	79.8	96	64	3.80	77.8	94	60
July	4.54	81.3	95	69	9.15	79.9	96	63	6.68	79.9	96	64
August	2.83	83.0	94	70	3.93	79.9	97	63	4.53	80.1	95	65
September	9.18	80.8	92	67	4.80	78.2	94	64	7.24	79.2	96	63
October	6.96	77.8	92	62	2.43	.....	.....	.....	7.00	76.4	93	58
November	8.26	72.1	86	38	1.41	.....	.....	.....	6.43	69.8	88	34
December	5.49	69.5	85	42	3.42	67.5	88	48	4.57	68.4	88	40
1915.												
January	2.80	67.3	82	40	3.00	62.9	83	38	2.92	.....	.....	.....
February	2.44	66.0	84	41	1.94	64.8	84	42	2.62	.....	.....	37

Of the stations indicated, two—Fort Lauderdale and Davie—are within the Fort Lauderdale area. Ritta is on the shore of Lake Okechobee, only a short distance from the western boundary of the area. This table is inserted to indicate the differences of temperature and precipitation, Fort Lauderdale being typical of the coast region, Davie of the eastern edge of the Everglades, and Ritta of the lake shore.

AGRICULTURE.

During the year 1896 the trucking industry had its beginning, being contemporaneous with the extension of the Florida East Coast Railway from West Palm Beach to Miami. With transportation facilities at hand a few areas were devoted to the production of

tomatoes and eggplant. These crops were grown for the most part on hammock lands of a prevailingly sandy character. Orange and grapefruit trees were set out at this time.

The yields of tomatoes and eggplant, together with the current high prices, warranted an increased acreage, and by 1899 probably 100 acres of these crops were planted. This increase continued yearly, and during the period from 1903 to 1905 it was noticeably large. It is reported that as many as 10 to 18 cars of vegetables were shipped daily from Fort Lauderdale and large quantities from Dania in the height of the season. There was a rush for land suitable for the growing of tomatoes, which were the principal crop. In 1905 a small acreage was planted to beans, Irish potatoes, and peppers. The yields obtained, in connection with the satisfactory prices received for these crops, justified an extension of their acreage.

The experience of many of the older and more prominent truckers is that the yields formerly obtained per acre were in excess of those secured now. Yields were greater even 5 years ago than now (1915), and occasionally 500 to 700 crates of tomatoes were gathered from an acre. They also state that in their experience it is best to change fields, new lands being desirable for truck crops. Old fields will not stand as much fertilizer or, in other words, will not give as profitable returns for the same expenditure as will new fields. Practically all the lands, except some of the hammocks, suitable for trucking in the vicinity of Fort Lauderdale and lying within reach of transportation facilities have been used or are now occupied.

In the Fort Lauderdale area the agriculture is largely confined to the eastern part of the survey in the vicinity of Fort Lauderdale, Davie, and Dania. Some little development is taking place on the south shore of Lake Okechobee and at the cross canal in the Everglades. From the locks on the North New River Canal to near the cross canal, covering a distance of about 45 miles, agricultural development has not as yet begun.

In the Fort Lauderdale area the agriculture consists of the production of truck crops and citrus fruits for northern markets.

Tomatoes are the largest and most important truck crop grown. They are grown under the widest and most divergent soil conditions of any crop. Beans are grown commercially by a number of truckers, but the acreage devoted to their production is much smaller than that devoted to tomatoes. Irish potatoes are grown to some extent on a commercial scale. A few eggplants are grown on some of the Muck, Black nonfibrous peat, and sand soils. Peppers in this survey are a relatively unimportant crop. Cabbages, turnips, onions, sweet potatoes, okra, lettuce, radishes, strawberries, cucumbers, English peas, carrots, squash, and celery are grown for home use and to supply local markets.

Nassau corn, a short-grained yellow corn, having a small ear, does well on some areas of Muck and Portsmouth soils. Iron cowpeas are said to give fair returns, and are more generally free from rust than many other varieties. Japanese sugar cane does well, making good feed for hogs and cattle.

A few pineapples are produced on the fine white sands. The best field was noted just north of Dania. Bananas are grown to a limited extent on nearly every farm for home use as well as for local trade. Guavas are grown in the yards and orchards, and are used mainly in the manufacture of jelly. A few avocados or alligator pears and many papaya (papaws) are grown. Coconuts grow near the coast. Among the ornamental and shade trees which are planted the Australian pine and Eucalyptus are popular. These grow rapidly and thrive on all the well-drained soils.

Grapefruit and oranges are grown on the Portsmouth fine sand, Muck, and sand hammocks near Fort Lauderdale, up New River in the vicinity of Dania, and to the west thereof toward Davie. Young trees on the Black nonfibrous peat at Davie show a thrifty condition and give promise of satisfactory results as long as the water table is controlled.

The hammock lands support a rather heavy growth of trees, and the removal of these and the stumps and roots is quite expensive. The white sands, such as those lying between Fort Lauderdale and Dania, are also difficult to prepare for cultivation, as the pines and their stumps and the palmetto roots must be removed before the land can be put in good condition. Throughout the vast reaches of the Everglades considerable work is required to prepare areas of Peat and Muck for planting crops. The prevailing growth is saw grass, interspersed here and there on the eastern edge by clumps of myrtle (see Pl. II, figs. 1 and 2) and on the rim of the lake by an outer belt of custard apple from three-fourths mile to 2 miles wide (see Pl. III, fig. 1) and an inner belt of willows of about the same width (see Pl. III, fig. 2).

Most of the hired labor in the area is colored, and laborers receive from $1.25 to $1.75, averaging about $1.50 per day. The preparation of the land, transplanting, cultivating, and picking is done by the day, while the packing of the vegetables into the crates is at the rate of 5 cents per crate. The packing-house work, such as grading the vegetables and making and nailing up the crates, is done by the day, and the wrapping and packing by the crate. A considerable part of the truck crops is packed ready for shipment at public packing houses. These establishments furnish the crates, grade and wrap and pack tomatoes and eggplant for 35 cents per crate. The tendency at present is toward having more of the vegetables handled in

this way. However, quite a large quantity is packed by the individual growers. Beans and Irish potatoes are packed in the field as soon as gathered.

Truck or citrus-fruit farms usually contain only a few acres; especially is this true of those near Dania, Davie, and along New River up from Fort Lauderdale. Near the cross canal and throughout the Everglades 10 acres constitute a tract, representing the selling unit. Bordering Lake Okechobee, the holdings vary considerably, ranging from 10 to 40 acres. The State of Florida and also several land companies own vast areas in the Everglades.

Land values vary widely, depending upon the character of the soil, drainage conditions, transportation facilities, and location with respect to towns. According to the best information obtainable, within the area land values are about as follows: Grapefruit and orange groves in good bearing in the vicinity of Fort Lauderdale usually sell for $1,000 to $1,500 per acre, while uncleared lands suitable for citrus fruit in the same locality are held at $75 to $200 per acre. Truck lands, cleared and ready for cultivation, bring from $100 to $300 per acre. The white sands situated a considerable distance from town sell for $30 to $60 per acre. Areas of Muck bordering the shores of Lake Okechobee are held at $40 to $100 per acre. These prices are presumably based upon or related to the earning capacity of the several soils, or the possibilities of use as determined by the success of agricultural enterprises on areas of similar soils. Along the North New River Canal the Peat is being sold by the development companies at prices ranging from $20 to $65 per acre. Since agriculture is not developed on this type it is evident that the prices are not based upon the earning capacity of the land and, since as stated in the description of the type, page 35, fibrous peat deposits the world over have largely remained unutilized, it would appear doubtful just what these prices are based on.

When the land is not tilled directly by the owner, the customary rent is from $5 to $10 per acre, depending upon soil and location. The share system, or "cropping" system, is in vogue in some regions. By this method the owner furnishes the land, fertilizer, seed, and insecticides, the renter does all the work, and each takes an equal share of all the profits accruing from the sale of the crop.

As is the general practice throughout the trucking regions of the South, complete ready-mixed fertilizers are used on all truck crops grown on a commercial scale. From about 1,000 to 3,000 pounds per acre of a high-grade mixture, costing $30 to $38 per ton, are applied. Four applications of fertilizer is the usual practice for tomatoes. Where it can be procured, most truckers prefer to use from one-half to 1 ton of stable manure with 100 pounds of fertilizer at the time of transplanting. This is followed in 15 to 18 days

by the addition of 400 pounds of a 6–4–5 formula.[1] The third application consists of 600 pounds and the fourth 900 pounds of 5½–2½–10, or some use 8–2½–10 and apply only three times. The first-mentioned fertilizer makes the growth of plants and the other, higher in potash, increases the quantity and quality of the fruit.

Soil for beans is fertilized with 400 to 1,600 pounds or more of fertilizers of various formulas, 6–2½–10, 8–2½–10, and 6–4–5 mixtures being used by different truckers. The fertilizer is used in several applications. For potatoes 600 to 1,000 pounds per acre of an 8–2½–10 mixture is commonly used. Land for peppers and eggplant is fertilized very much like that for tomatoes, the fertilizer being used in four or five applications.

Few growers attempt the production of citrus fruits without the use of commercial fertilizers. Various mixtures are used, but the 5–7–10 formula is perhaps the most popular. After the first year the trees receive about 3 pounds each, and this is gradually increased until 10 to 12 pounds is applied three times a year to large bearing trees.

SOILS.

In its geographic relations the Fort Lauderdale area forms a portion of the Florida Peninsula and is entirely included in the Atlantic Coastal Plain. The underlying rock, which outcrops only in a few places on the rock rim, is everywhere limestone of very recent geologic age. This limestone bedrock shows marked variation in texture and composition. That part of it lying beneath the rock rim and the eastern edge of the Everglades is a soft arenaceous limestone of ooliticlike texture. Westward this gives place to a fossiliferous limestone composed to a marked degree of shells of marine mollusks. Nearer Lake Okechobee the rock is firm, fine grained, in places containing chert and flint nodules, and is quite hard.

The materials overlying the limestone are chiefly quartz sand, marl, and organic matter, and in no case do they appear to be residual from the rock, but rather to have been deposited upon its surface as distinctly separate material.

Considered on the basis of origin the soils of the area may be classed in two main groups: (1) Soils derived from, or composed chiefly of, recent marine sediments, and (2) cumulose soils, composed mainly of vegetable matter in various stages of disintegration and decay, with admixture of various quantities of extraneous inorganic material.

The soils derived from marine sediments fall naturally into several series, the differences being based upon variations in the original material and upon changes which have taken place since deposition. The basic material of most of the soils of this group is fine quartz sand. As originally deposited this sand was probably clean and

[1] Fertilizer formulas are stated in the order: Phosphoric acid, nitrogen, potash.

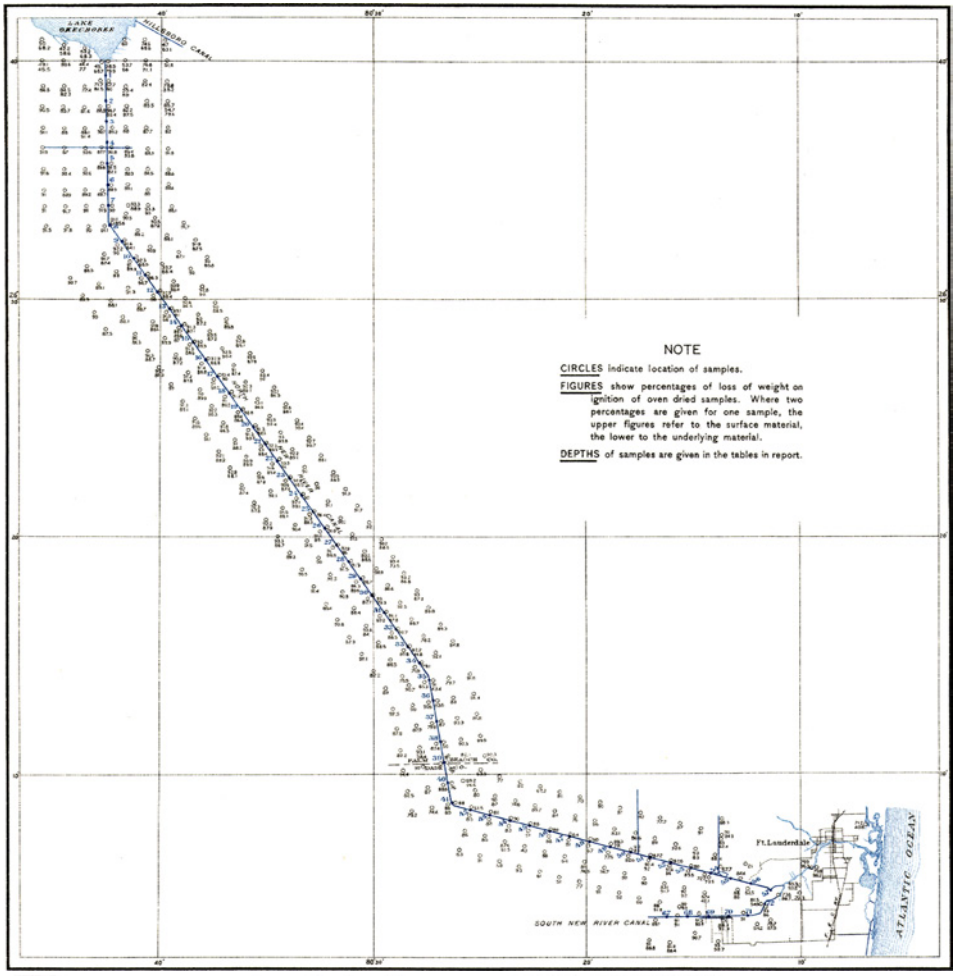
practically free from organic matter. Under certain conditions of topography and drainage it has remained in this condition, and those soils which are thus composed of clean white quartz sand to a depth of 3 feet or more are classed with the St. Lucie series. In slight depressions of deficient natural drainage, and under conditions favorable to the accumulation of organic matter, the quartz sand has become mixed with decaying vegetable tissue in varying proportions. Where the amount of organic material is only sufficient to color the surface few inches a gray to dark gray, the soil is classed with the Plummer series. The soils having dark-gray to black surface soils are grouped with the Portsmouth series. In places on the rock rim the surface mantle of fine sand overlying the limestone is less than 3 feet thick. Where such a condition exists over sufficient territory to warrant separation, the areas are shown on the soil map as the Dade fine sand. If in such cases the surface fine sand is black and otherwise similar to the Portsmouth, the soil is mapped as a phase of the Portsmouth fine sand.

On the beach ridges near the ocean and adjoining the lagoon the sand is composed of quartz grains mixed with small fragments of the shells of salt-water mollusks, which have been broken up and washed ashore by the waves, to be carried inland by on-shore winds and fixed in place by vegetation. Such a soil, consisting of a high percentage of calcareous material, differs sufficiently from the purely quartz sands to warrant separation from them. It is shown on the soil map as Palm Beach sand.

The low, flat land lying between the rock rim on the west and the beach ridge on the east is partly above the influence of tidewater and partly subject to periodic inundation. The greater part of it which lies above the influence of salt water is a gray to brown, soft, silty material high in lime content, light gray when dry, and locally known as "marl land." This soil is mapped as the Parkwood silt loam. An area of similar material lying to the east of the typical soil is subject to tidal inundation and is separately indicated on the map. Westward from the main area of the Parkwood silt loam and in separate depressions are smaller areas of similar marly material probably laid down under the same conditions, but in these cases the deposit is thinner, and the underlying muck or sand is present within the 3-foot section.

In point of territorial extent the cumulose soils are by far the most important of the Fort Lauderdale area. Three hundred and twenty-six square miles are included in this general group, embracing many different conditions of depth, underlying material, and vegetation, and showing great variation in composition and texture.

From the edge of the rock rim to the shores of Lake Okechobee the soils mapped in this survey are composed largely of organic matter in



POSITION OF WATER TABLE AS DETERMINED DURING THE PERIOD FROM JANUARY 22 TO MARCH 16, 1915.

various stages of disintegration and decay. These soils have been grouped in the mapping according to the percentage of mineral constituents and the present stage of decomposition of the vegetable tissue. Near Lake Okechobee the material is black and well decomposed, averages about 60 per cent of ash content, and is classified as Muck. The inorganic matter in this case consists chiefly of fine sand, silt, and clay, and is intimately intermixed with the organic constituents, giving the Muck a heavy silty texture. South of this area of Muck there is a gradational belt of less decomposed material with a smaller percentage of mineral matter, mapped as Peaty muck. Approaching the interior of the Everglades, the material becomes less decomposed, and is nearly pure organic matter. Two and three miles south of the lake the surface material is a brown fibrous peat averaging 85 to 93 per cent of combustible organic matter. This area is uniform in composition and texture for many square miles. As the coast country is approached areas are encountered in which the material contains sufficient quartz sand to raise the inorganic content to 16 per cent or more. These areas are indicated as sandy phases. A further differentiation is based upon the character of the underlying substratum. Those areas which overlie limestone are separated from areas the underlying material of which is sand. Near the rock rim two distinct classes are mapped. Both are high in organic content, with an average of about 90 per cent of organic matter, but in one case the surface material is black and decomposed and in the other it is brown and fibrous. In this section of the survey differentiations are also based upon the depth of the organic material; areas in which it is less than 3 feet deep are indicated upon the soil map as phases, distinct from the typical deep deposits. Two special phases are mapped; one includes an area where the sand lies within 12 inches of the surface, the other, indicated as the cypress island phase, represents an intimate association of open glade areas of peat and small islands rising a few feet above the general level, which are covered with cypress and myrtle.

A few areas of Muck less than 36 inches in depth are associated with the peat and soils of the eastern edge of the glades. In the depression between the rock rim and the coastal bar there is an area of highly organic material subject to tidal inundation which is indicated as a salt water phase of the Peaty muck.

During the progress of the survey numerous samples of the cumulose soils were collected and the percentages of loss on ignition determined. This method indicates approximately the combustible organic content of the material. The appended map (Plate B) shows the locations from which the samples were taken and the per cent of loss on ignition of the oven-dried sample in each case. The samples were taken with 1½-inch steel soil augers, equipped with extensions. The

samples include the material in a boring of that diameter from the surface to the underlying sand or rock. Where the material was fairly uniform but one sample was taken; in borings where the appearance of the material seemed to indicate differences two, and in some cases three, samples were taken and separately analyzed.

Throughout the greater part of the area the samples were collected on lines projected at right angles from the canal at each milepost. They were taken on each side of the canal, one at 300 to 1,000 feet from its banks, a second 1 mile out, a third 2 miles out, and in some cases a fourth 3 miles distant.

The following table gives the name and actual and relative extent of each soil type mapped in the Fort Lauderdale area:

Areas of different soils.

Soil.	Acres.	Per cent.
Peat	193,536	85.7
Brown fibrous peat:	*Acres.*	
Deep over limestone	136,704	
Sandy phase, deep over limestone	23,232	
Deep over sand	14,464	
Sandy phase, deep over sand	4,992	
Shallow over sand (12–36 inches)	3,904	
Sandy phase over sand (2–12 inches)	1,024	
Sandy phase over sand (12–36 inches)	832	
Black nonfibrous peat:		
Shallow over sand	3,776	
Deep over sand	2,624	
Timbered phase	896	
Cypress island phase	704	
Deep over limestone	384	
Muck	8,448	3.7
Muck (typical)	6,336	
Shallow phase	2,112	
St. Lucie fine sand	7,808	3.5
St. Lucie fine sand (typical)	1,088	
Flat phase	4,992	
Poorly drained phase	1,728	
Peaty muck	6,720	3.0
Peaty muck (typical)	4,544	
Salt water phase	2,176	
Dade fine sand	2,944	1.3
Dade fine sand (typical)	2,496	
Hammock phase	448	
Portsmouth fine sand	2,560	1.1
Portsmouth fine sand (typical)	1,344	
Hammock phase	960	
Limestone-substratum phase	256	
Parkwood silt loam	2,560	1.1
Parkwood silt loam (typical)	1,344	
Shallow phase	576	
Salt water phase	640	
Plummer fine sand	576	0.3
Palm Beach sand	448	0.2
Total	225,600	

Palm Beach Series.

The Palm Beach soils are characterized by the brown to dark-brown color of the surface material, by the grayish or grayish-brown or speckled color and loose structure of the subsoil, and by the presence of large quantities of small shells and shell fragments. They are composed of sand which has been subjected to the weathering of the waves and tides, mingled with fragments of shells and small shells, and finally blown beyond the reach of the sea water and held in place by vegetation. The brownish color is due to the accumulation of vegetable matter and to the impurities giving rise to the various colorations of the shells. The series may be considered as intermediate between the Coastal beach and the white siliceous sands of the mainland. The distinguishing growth is cabbage palmetto, coconut palms, and sea grapes. One type, the Palm Beach sand, is mapped.

PALM BEACH SAND.

The surface soil of the Palm Beach sand is a grayish-brown to dark-brown slightly loamy sand extending to a depth of 6 to 10 inches. This is underlain by a yellowish-brown or speckled sand of loose structure, which extends to a depth of 36 inches or more.

The surface soil and the subsoil both consist primarily of a mixture of slightly rounded to subangular quartz sand grains and calcareous shell fragments, in varying proportions. The darker color of the surface soil is due to the accumulation of disintegrated vegetable matter, which is not present in the subsoil.

The areas of Palm Beach sand as mapped form well-drained ridges 6 to 12 feet high parallel to the coast line. The most extensive of these areas, immediately adjacent to the ocean, varies in width from a hundred feet to a quarter of a mile, and, excepting the break at the New River Inlet, is 6 miles long. Very narrow strips of this occur on the windward sides of the mangrove swamps, immediately adjacent to the inland lagoon. As mapped there is a very narrow strip of Coastal beach included with the Palm Beach sand which differs from the typical soil in being subject to wash by the waves, and practically barren of vegetation.

The typical native growth on this soil type consists of a rather heavy jungle of live oak, rubber trees, sea grape, gumbo limbo, cabbage palmetto, seven-year apple, vine cactus, saw palmetto, and ferns. In places cocoa-plum bushes are fairly abundant, and near the ocean bear grass is found in isolated bunches. The coconut palm, though not native, thrives on this soil and fruits abundantly, and many of them have been planted.

Owing to its small extent and its location, the Palm Beach sand is not of agricultural importance in this area. Much of it will probably be used in the future for residence purposes, many locations having already been subdivided.

St. Lucie Series.

The St. Lucie soils are characterized by their white color, loose structure, and droughty nature. They are typically developed on the east coast of the Florida Peninsula, but small areas are occasionally encountered in other southern States. These soils consist of almost pure quartz sand, there being but a slight admixture of vegetable matter in the first few inches. Naturally they are soils of extremely low productivity. Spruce pine, with an undergrowth of scrub oak, a scattering of saw palmetto, and ceratiola constitute the typical natural vegetation upon this soil. Only one type is mapped.

ST. LUCIE FINE SAND.

The St. Lucie fine sand typically consists of a white, loose fine quartz sand, 3 feet or more in depth. The immediate surface is in places light gray, owing to the inclusion of a very small percentage of organic matter, but usually there is no variation in texture or color from the surface downward throughout the 3-foot section. This type occupies flat to very slightly undulating areas which are usually somewhat elevated above the surrounding country. This slight elevation and the extremely porous nature of the material render drainage excessive.

The areas of the typical St. Lucie fine sand are all north of New River and are of relatively small extent, comprising in the aggregate less than 2 square miles. None of the type is under cultivation in this area, and it would require extraordinary fertilization, especially the addition of organic matter, and thorough irrigation to fit it for any commercial crop. Its most profitable use would be for pineapples.

The original vegetation consists of spruce pine, ceratiola, some live oak, scattered saw palmetto, and small, gnarly Florida pine.

St. Lucie fine sand, flat phase.—The surface soil of the flat phase of the St. Lucie fine sand is a light-gray fine sand, consisting almost entirely of somewhat rounded to subangular quartz grains, with some slight intermixture of finely divided organic matter. The subsoil below 6 or 8 inches is a light-gray to white fine quartz sand, with little or no admixture of foreign material.

The surface of the areas of this type is level to gently undulating, and usually somewhat lower than that of the typical St. Lucie. Drainage is usually good to excessive, owing rather to the porous nature of the soil than to topography. The water table is normally much nearer the surface than is the case with the typical St. Lucie, resulting in marked differences in vegetation.

This phase is found in areas of irregular size and shape in the eastern part of the Everglades area, chiefly in the neighborhood of Fort Lauderdale. In fact, this town is built largely upon this type of soil.

Isolated areas, locally called "islands," entirely surrounded by cumulose soils, are encountered north and northwest of Davie. Pine Island is an irregular elevated strip, rising 2 or 3 feet above the surrounding glades, the higher portion of which is occupied by this phase.

The native vegetation of the flat phase of the St. Lucie fine sand is chiefly Florida yellow pine, with an undergrowth of saw palmetto and in places scrub oak. This characteristic vegetation has given rise to the local name "palmetto flatwoods." Some very small areas upon which the native growth consists of cabbage palmetto, live oak, sweet bay, and other trees are included with this phase. These areas occur mainly near the river and fringing adjoining soils, such as the hammock phases of the Dade and the Portsmouth fine sands.

Though of rather extensive occurrence in the Fort Lauderdale area, this phase is but little used at present for agriculture.

A few citrus groves have been set out on this soil, and these are located mainly upon areas which originally supported a hammock vegetation. One such grove, on the banks of the river about 2 miles above Fort Lauderdale, is producing fairly well, but in this case the underlying limestone is within 4 feet of the surface. This phase is used to some extent as a trucking soil.

St. Lucie fine sand, poorly drained phase.—To a depth of 3 feet or more the St. Lucie fine sand, poorly drained phase, is a white fine sand with an immediate surface layer of brown organic matter. This surface material is typically less than an inch thick and consists of partially decomposed vegetable matter. In places, especially in the hammocks and near the boundaries of the areas of this phase, this surface coating attains a thickness of about 3 or 4 inches and is frequently dark brown and mucky. Under cultivation this organic matter is plowed under and becomes mixed with the sand.

This phase of the St. Lucie fine sand is developed in the country west of Fort Lauderdale, on the edge of the Everglades. One large area extends from about a mile north of the North New River Canal northward to the boundary of the township, and averages about a mile in width. Smaller areas lie east of this, while a second good-sized area is mapped just north of Davie.

The topography of this phase is level and drainage is naturally poor. The western portion of the largest area is covered with water much of the time and practically all of it is subject to occasional inundation, resulting from heavy rainfall.

The native vegetation of this soil consists of stunted pond cypress, myrtle, and cocoa plum in clumps, the open spaces being covered with a sparse growth of water-loving grasses.

Only a small percentage of the phase is under cultivation in this area. The only commercial crop grown to any extent is tomatoes,

which are planted through the late fall and winter to supply the winter and early spring markets of the North. The young plants are set out on ridges for protection against drowning and killing by frost. Complete fertilizers of various brands and mixtures, usually of a 6–4–5 formula, are applied three or four times during the growth of the plants, and spraying, usually with Bordeaux mixture or similar compounds, is found necessary for protection against the tomato worm and fungous diseases.

Plummer Series.

The Plummer soils are prevailingly gray and underlain at a depth varying from 8 to 20 inches by light-gray or whitish material, being occasionally more or less mottled with yellow or brown. They occupy flat, level, poorly drained, water-logged areas, being frequently covered with water. These soils are developed in the flatwoods region or the seaward portion of the Coastal Plain. A scattering of cypress and longleaf pine, scattered clusters of saw palmetto, some cabbage palmetto, and gallberry, pitcher plant, and broom sedge constitute the vegetable growth. Only one type is mapped in this area, and this is of minor importance.

Plummer fine sand.

The surface soil of the Plummer fine sand to a depth of 10 to 20 inches is a gray fine sand. The subsoil is a light-gray to white fine quartz sand stained in places with yellow and brown organic compounds and iron oxides. In small areas included with this type the underlying limestone is within 3 feet of the surface and in such places the soil has a yellowish-brown color and is slightly more loamy than usual.

The Plummer fine sand occupies flat, poorly drained areas, mainly west of Fort Lauderdale, and is associated with the St. Lucie and Portsmouth soils. These areas are at times covered with shallow water, but usually the water table is a few inches below the surface.

The typical vegetation of the Plummer fine sand consists of Florida yellow pine, wire grass, gallberry, and scattered clumps of saw palmetto, with a few cabbage palmetto in isolated clusters. Stunted pond cypress grows in some of the wetter areas. Small sundew is also characteristic of this soil.

Only a few areas of this type are under cultivation. The only commercial crop of importance is tomatoes. This crop is planted on ridges in the uncleared flatwoods. The methods of cultivation, fertilization, and yields are similar to those on the poorly drained phase of the St. Lucie fine sand.

Portsmouth Series.

The Portsmouth soils are dark gray to black, and usually high in vegetable matter. The subsoils are prevailingly light gray, mottled gray and yellow, or white or brown colored. The subsoils of the heavier members are always slightly plastic, though commonly carrying a noticeable amount of sand. These soils are developed in flat to slightly depressed, poorly drained situations, and require ditching before they can be used for agriculture. The series is developed in the flatwoods, or the low regions of the Coastal Plain east of the Mississippi. In this survey only the fine sand type is mapped.

Portsmouth fine sand.

To a depth of 8 to 12 inches the Portsmouth fine sand is a dark-gray to black fine sand, rich in organic matter. In places this organic matter is present in sufficient quantities to give the soil a distinctly loamy texture. The subsoil is usually a light-gray to brownish-gray fine sand, saturated with water in the lower part. In many areas there occurs at depths ranging from 20 to 36 inches a brown "hardpan" stratum varying in thickness from 2 to 8 inches. This hardpan layer consists of quartz sand loosely cemented by brown organic compounds, and though more compact than the nearly pure quartz sand, it is readily penetrated with the soil auger. A few areas were encountered in which the limestone bedrock lies sufficiently near the surface to influence agriculture. Where the rock is within 3 feet of the surface and the areas sufficiently large to indicate on the map, they are mapped as a limestone substratum phase of this type.

The Portsmouth fine sand is distributed in rather small, irregular areas over the "rock-rim" country lying between the ocean and the Everglades. It is developed in connection with the St. Lucie and Plummer soils, occupying the more poorly drained depressions where conditions have been favorable for the accumulation of organic matter. The native vegetation of the typical soil consists of Florida yellow pine, a scattering of saw palmetto, and wire grass, gallberry, huckleberry, and numerous flowering herbs of minor importance. Myrtle, willow, cypress, and cabbage palmetto are found in scattered clumps, but these plants are more typical of the hammock phase of this type.

Because of poor drainage conditions, most of the areas of this soil are not suitable for agriculture in their natural condition. Open ditches have been constructed in places, and where good drainage has been established the type is considered one of the best trucking soils in the area.

Tomatoes and beans are the most important crops grown. Bananas, peppers, eggplant, potatoes, sweet potatoes, and yams are minor crops. Yields of tomatoes average about 225 crates per acre in normal seasons. Fertilizer is usually applied at the rate of 1 ton per acre. Various mixtures are recommended by different growers. Some use a 6–2½–10 mixture; others use two mixtures, one a 4–5–6, used in two applications of 500 pounds each, the other a 5–6–10, applied in the same amounts. Beans yield in good seasons 150 to 200 hampers per acre. They are fertilized with a 6–2½–10 mixture at the rate of about 1 ton per acre. Some truckers apply nitrate of soda while the plants are in bloom.

The Portsmouth fine sand is held at prices ranging from $75 to $250 an acre, depending on location with respect to shipping points.

Portsmouth fine sand, hammock phase.—The surface soil of the hammock phase of the Portsmouth fine sand is a black loamy to mucky fine sand to a depth of 8 to 15 inches. The subsoil to a depth of 36 inches or more is typically a gray to light-gray fine sand, usually saturated with water under present drainage conditions. The layer of hardpan described under the typical soil is present in some places beneath the hammock phase. The limestone substratum is encountered at about 3 to 4 feet below the surface over comparatively large areas. Such is the case in those areas lying just south of the North Fork of New River, 2 or 3 miles northwest of Fort Lauderdale.

The organic content which imparts the black color to the surface soil is quite variable. In places it consists of a surface layer of fine muck 2 to 6 inches thick, but usually it occurs as finely divided material scattered rather uniformly throughout the sand. In general it is more abundant and extends to a greater depth than in the typical Portsmouth fine sand.

The areas of this phase all lie west, northwest, and southwest of Fort Lauderdale, east of the glades. They occur chiefly near the river and are often associated with areas of Muck. The topography is level and in places depressed and natural drainage is usually poor. The proximity to streams in most cases provides opportunity for artificial drainage and ditches have been constructed in many places.

The original vegetation consists of a hammock growth of cabbage palmetto, bay, wild fig, myrtle, and a scattering of Florida pine, with areas in which cypress is prominent. In some of the more open spaces saw palmetto, gallberry, huckleberry, and wire grass constitute the undergrowth. Broom sedge often grows fallow land.

Where drainage has been established this phase of the Portsmouth fine sand is one of the most valued trucking soils of the Fort Lauderdale area, although clearing is quite expensive. Trucking is the

chief agricultural industry, the methods of cultivation, fertilizer requirements, and yields being similar to those on the typical Portsmouth fine sand. It has been found advisable to leave a part of the original hammock growth standing on the north and west sides of the truck patches, as a protection against the cold winds and frosts during the winter. This phase of the Portsmouth fine sand is considered to be better adapted to citrus fruits than is the typical soil.

Portsmouth fine sand, limestone-substratum phase.—The surface soil of the limestone-substratum phase of the Portsmouth fine sand to a depth of 6 to 12 inches is a dark-brown or dark-gray to black slightly loamy fine sand. The subsoil is a brown fine sand which is underlain by limestone at 15 to 36 inches below the surface. The surface of this limestone is irregular and pitted so that its depth is extremely variable even over a small area.

This soil is of minor importance in the Fort Lauderdale area, in only a few places being of sufficient importance to warrant indication on the soil map. The largest area lies about 2½ miles south of Fort Lauderdale. Several small areas are included with the typical Portsmouth fine sand and with the hammock phase of the type.

This phase occupies areas of nearly level to gently undulating topography, slightly elevated above the areas of Portsmouth fine sand. Its natural drainage is better than that of the typical soil, and on much of the land ditching is not necessary.

The original vegetation consists of cabbage palmetto, cypress, myrtle, bay, Florida pine, and other trees and shrubs, with an undergrowth of saw palmetto, gallberry, huckleberry, and wire grass. Abandoned fields tend to grow up in fennel and ragweed.

The limestone-substratum phase is used for truck crops and citrus fruits. Its agricultural utilization is similar to that of the typical Portsmouth fine sand, but it is held in higher esteem by truckers because of its greater moisture-retaining capacity. It is also probable that the influence of the limestone substratum tends to counteract any acidity of the soil.

Dade Series.

The Dade soils are characterized by their prevailingly white color and the loose structure of the surface material and the presence of the arenaceous limestone substratum of bedrock, which is reached at varying depths within the 3-foot section. Outcrops of this limestone frequently occur on the knolls. Lying between the white sand and the limestone is a thin layer, usually from 1 to 4 inches in thickness, of a brownish-yellow or orange sand. The separation of the Dade soils from the St. Lucie is based essentially upon the underlying limestone, which evidently influences the agricultural value, rendering the Dade soils more productive and suitable to a

wider variety of crops than the St. Lucie and Leon soils. The Dade soils are typically developed in the Florida Peninsula between West Palm Beach and Miami. The surface is level or undulating to gently rolling, being slightly elevated above the surrounding soils. The soils of this series are derived from unconsolidated marine material of recent geologic age, with possibly some influence in the lower subsoil from the underlying consolidated limestone. Only the Dade fine sand type is mapped.

DADE FINE SAND.

To a depth ranging from a few inches to 3 feet the Dade fine sand is a light-gray to white fine quartz sand. The underlying substratum of limestone has a very irregular, pitted surface, with potholes 3 to 5 feet deep, and the sand covering therefore shows a wide variation in depth even in local areas. In places on the higher ridges and knolls the rock outcrops in small, irregular patches.

In general the surface material to a depth of 6 or 8 inches is slightly darker in color than the underlying material, owing to the presence of a small amount of finely divided organic matter disseminated throughout the surface sand. Between the white sand and the limestone there is usually present a thin layer of yellowish-brown to orange-colored fine sand, which is slightly loamy in texture. This loamy layer is variable in thickness, averaging about 2 inches. In places it is absent.

The topography of this type is level to ridgy. It is usually elevated above the surrounding soils. This elevation is especially marked at the boundary between the Parkwood silt loam and the Dade fine sand in the eastern part of the area.

One large area of the Dade fine sand lies east of Fort Lauderdale and north of New River and another about 4 miles southwest of Fort Lauderdale. South of New River this is one of the most important soil types of the rock rim, covering a considerable part of the area between Fort Lauderdale and Dania. West of Dania other areas are mapped, portions of which lie beyond the south township line.

But a small proportion of this type is under cultivation; the greater part of the area is still covered with the original vegetation, consisting chiefly of Florida yellow pine, saw palmetto, and coontie. It is generally considered a stronger soil than the St. Lucie fine sand, being preferred by most growers for citrus trees. Pineapples are grown to a small extent on this soil, but are not especially adapted to it. Small patches of bananas, sweet potatoes, and beans are grown and where properly fertilized do fairly well.

Dade fine sand, hammock phase.—The hammock phase of the Dade fine sand to a depth of 6 to 10 inches is a light-gray fine sand.

This grades into a nearly white fine sand, which is underlain by a stratum of brown fine sand, 2 to 12 inches thick. This stratum of brown fine sand, which is composed of quartz sand stained with some organic compound, or iron oxide, immediately overlies the limestone bedrock.

This phase usually occurs in association with the typical Dade fine sand, in the same topographic situations. Irregular areas occur in the rock-rim country east of the Everglades. The largest and most important of these areas lie south of New River and west and northwest of Dania.

The distinguishing feature of this phase, the basis of its separation from the typical soil, is the heavy hammock vegetation, consisting of live oak, bay, cabbage palmetto, gumbo limbo, bamboo brier, and other trees, shrubs, and vines.

A difference in the agricultural value of this phase and the typical Dade is recognized by citrus fruit growers, and the hammock land is prized for grapefruit and orange groves. Established groves are held at $1,000 to $1,500 per acre, and, if properly managed, are said to pay good returns on that investment. Uncleared areas of this soil range in price from $75 to $200 an acre.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the typical Dade fine sand:

Mechanical analyses of Dade fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
261509	Soil	0.2	8.4	24.0	64.7	1.0	1.0	0.4
261510	Subsoil	.2	5.2	18.4	73.3	2.0	.8	.1

PARKWOOD SERIES.

The Parkwood soils, locally called "marl land," consist of brownish-gray to gray silt loam, containing small shells and drying out to a light or almost whitish color. They are characterized by an extremely high content of lime and by unusual textural and structural uniformity throughout the soil profile of 3 feet. Spots of mucky material are common in the depressions and may occasionally be encountered in the lower depths of the typical soil. Mottlings of yellowish-brown, due to the segregation of iron compounds, and frequently occurring in the form of stems and accretions, are sometimes seen in the upper 18 inches. These soils are developed in the old sounds and lagoons lying between the mainland and the salt water marsh, or beaches, and have been formed from the ooze and fine sediments of marine formation and shells. The surface is practically flat, with

only an appreciable gradient toward the coast, the water usually being near the surface. Frequently covered with salt water during high tides. The silt loam is the only member of the series mapped

PARKWOOD SILT LOAM.

The Parkwood silt loam, commonly called "marl land," consists of a prevailingly brownish-gray to gray silt loam of uniform texture and smooth, mellow structure throughout the 3-foot section. This type is extremely high in lime content and contains a large quantity of shell fragments. The material dries out to a light-gray or whitish color, and locally it becomes hard and intractable, making cultivation somewhat difficult. Frequently mottlings of yellowish-brown, and also stems and accretions of iron crust, formed by the segregation of iron oxide, are noticeable in the upper portion of the soil. Where this iron occurs in large quantities the surface soil has a more brownish yellow color. Between the typical soil and the upland on the west there is generally a very narrow band of Muck, and distributed throughout the type are patches of Muck which are of insufficient size to be shown on the soil map. Such spots occupy slightly depressed situations and have poor natural drainage. Occasionally the silt loam is underlain in the lower part of the 3-foot section by mucky material, but this variation has no apparent influence on the agricultural value of the soil. Where of sufficient size to warrant separation, the areas of this description have been mapped as the shallow phase of this type. It is not uncommon also to find some brown fibrous vegetable matter intermingled with the silt loam in the lower part of the 3-foot section, giving rise to a brownish cast in the material.

This type is confined exclusively to the eastern part of the area, where it occurs in one large, continuous strip extending from Dania to Fort Lauderdale, and in a smaller strip east of Fort Lauderdale. It is developed in the old sound or lagoonlike area lying immediately east of the rock rim.

The surface of the type is flat, having a slight gradient toward the coast. The only variation in the surface features is due to the presence of small roundish depressions which are hardly noticeable except in wet seasons, when they are frequently saturated or sometimes covered by water.

Owing to the uniformly flat surface and the low position of this soil, the natural drainage is inadequate. Ditching is resorted to as a means for the reclamation of this soil for agricultural purposes. A large canal leading east from Dania across the type into the inland waterway has been constructed for the purpose of supplying an outlet for the water from some of the lateral ditches, and also as a means of transportation by small boats. During storm tides the ditches throughout the type are practically filled with salt water, and

some of the depressions are inundated for short periods. Low dikes, in conjunction with flood gates in the open ditches, would protect the fields from invasion of the salt and brackish waters.

There is no evidence that the type ever supported a forest growth. There is an occasional cabbage palmetto, but the growth on the areas still in their original condition consists mainly of marsh grasses. Those areas which have been cultivated but are now "lying out" support a luxuriant growth of dog fennel, smartweed, ragweed, and coarse grasses.

The Parkwood silt loam appears well suited to the production of tomatoes, and this crop is grown almost to the exclusion of all others. Tomatoes yield from 75 to 300 crates per acre, depending upon the season, method of cultivation, and attention given to the crop. About 1 ton of stable manure and 100 pounds of a 6–4–5 fertilizer per acre are applied to the hills at the time of setting the plants. In about 15 to 18 days after planting 400 pounds of the same kind of fertilizer is placed around the plants. The third application consists of 600 pounds per acre of fruit and vine fertilizer ($5\frac{1}{2}$–$2\frac{1}{4}$–10), and 900 pounds of this same material is used at the fourth or last application. The Livingstone Globe is the standard variety for this soil. This bears in about 90 days. The best crops are secured in April and May. Cabbage does well on this soil, but there is no market for this vegetable. Some Nassau corn, Irish potatoes, peppers, and eggplant also are grown.

Land of this type is held at $100 to $200 per acre, depending on location and drainage conditions.

Parkwood silt loam, shallow phase.—The surface soil of the shallow phase is a gray to whitish silt loam, varying in depth usually from 8 to 30 inches. It contains a sufficiently large quantity of lime to be locally called "marl land," and shell fragments also are found. Under normal moisture conditions this is a smooth, mellow soil, but frequently it dries out to a whitish color, forming clods, which are unfavorable to the cultivation of the soil. Like the main type, this phase in places shows brownish-yellow mottlings and accretions of iron oxide in the upper part of the soil.

This soil is underlain by dark-brown to black peaty muck or muck. Frequently below 3 feet there is encountered a stratum of brown, fibrous, felty peat. In restricted areas the surface soil represents only a shallow covering of 2 to 8 inches of the gray silt loam overlying the peaty muck or muck, the peaty material being usually found under the muck. A dark-gray to almost black fine sand is frequently reached within 15 to 36 inches, and occasionally the silt loam rests directly upon the fine sand. These variations from the phase are of minor importance, and such conditions could not be shown on a map of the scale used.

In the areas of shallow surface soil the muck is frequently turned up by the plow and becomes mixed with the silt loam, giving it a more loamy structure and darker color.

The largest development of this phase is immediately west and northwest of Dania, where it occurs in a body about one-half mile wide and 2 miles long. A narrow strip is located just east of Dania, lying between the main type and the upland. A few small patches occur between Dania and Fort Lauderdale.

In topography this phase closely resembles the main type, having a prevailingly level and flat surface throughout. It is situated in the lagoon or basinlike locations between areas of the higher-lying sandy soils, and is closely associated with Muck.

Canals and open ditches are necessary in order to reclaim this soil to a condition suitable for agricultural utilization. It lies only a few feet above sea level, and by reason of its flat surface natural drainage is not well established. Most of the phase has already been drained, but during wet seasons it is likely to be flooded by rain water, this hindering the planting of crops and cultivation.

Practically all of this phase is or has been under cultivation. The yields are comparable with those on the main type, and the amount and kind of fertilizer used are practically the same. Tomatoes are the important crop, although a small acreage is devoted to the production of other truck crops.

Parkwood silt loam, salt water phase.—The salt water phase differs from the main type in that it occupies a slightly lower position, being subject to inundation by ocean tides. This phase comprises a strip varying in width from about one-eighth to nearly one-half mile, extending in a north-and-south direction, and lying between the typical soil and Peaty muck, salt water phase, on the east. Practically all of this phase is covered by mangrove bushes, with a thick growth of *Spartina* grass and an occasional cabbage palmetto.

The surface of this phase is uniformly flat and level, being only slightly elevated above mean tide. During high tide all of this land is inundated. In order to reclaim this phase it will be necessary to construct rather strong dikes and also to operate pumps for the purpose of removing rainfall and seepage water. The phase in its present condition is unfit for agricultural utilization.

The average results of mechanical analyses of samples of soil of the typical Parkwood silt loam are given in the following table:

Mechanical analyses of Parkwood silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
261546, 261548.....	Soil.....	0.6	2.0	1.4	3.6	1.9	74.8	15.7

Cumulose Soils.

MUCK.

Of the cumulose soils, i. e., soils composed mainly of vegetable matter, the Muck is the most valuable for agricultural use, its value being fully recognized and its possibilities being highly developed in many other areas which have been covered by the soil survey. It consists of black, finely divided and well-decomposed vegetable matter, containing a comparatively high percentage of fine sand, silt, and clay. The average loss on ignition of the oven-dried sample is about 60 per cent. The material is fairly uniform in texture, structure, and color to a depth of 40 to 75 inches. When wet it is slightly sticky and plastic, and somewhat compact. Upon drying it becomes quite hard, with a tendency to crack, exposing the material to evaporation. (See Pl. IV.)

The underlying material is a brown to dark-brown, firm peaty muck, with a felty structure. Limestone is encountered at depths ranging from 112 to 150 inches below the surface.

The results of ignition of oven-dried samples of this type are given in the following table:

Loss on ignition of oven-dried samples of Muck.

No. of sample.	Depth.	Loss on ignition (oven-dried samples).	No. of sample.	Depth.	Loss on ignition (oven-dried samples.)	No. of sample.	Depth.	Loss on ignition (oven-dried samples).
	Inches.	*Per cent.*		*Inches.*	*Per cent.*		*Inches.*	*Per cent.*
1	0 to 75	50	6	0 to 40	47	11*a*	66 to 144	79.9
1*a*	75 138	68.2	6*a*	40 112	63	12	0 60	53.7
2	0 70	42.2	7	0 55	49.1	12*a*	60 112	66
2*a*[1]	70 116	58.6	7*a*	55 108	45.5	19	0 50	53.7
3	0 60	52.2	9	0 60	44.4	19*a*	50 120	80
3*a*	60 120	68.3	9*a*	60 126	77	20	0 44	55.4
4	0 98	66	10	0 65	45	20*a*	44 114	89
5	0 70	74.6	10*a*	65 132	65.7			
5*a*	70 112	68.6	11	0 66	38.5			

[1] Samples marked with the letter "a" in this and subsequent tables giving loss on ignition represent underlying material from same location as sample immediately preceding.

But one area of typical Muck is mapped. It includes what is locally known as the custard-apple region bordering Lake Okechobee. Its width varies from about 1 to 2 miles; its area is 6,336 acres.

The surface of this area is practically flat and nearly level, with a very gentle slope away from the lake. The elevation is about 21 feet above sea level. A few sloughs or sluggish creeks head a few hundred yards back in this area and empty into the lake. Practically all of the area is free from standing water, the water table being 20 to 40 inches or more below the surface.

With the exception of a narrow strip near the lake, which is overgrown with creeping moonflower vines, nearly all the Muck area is forested with a growth of custard apple, covered with the moonflower vines. The undergrowth consists chiefly of ferns, notably the giant agrosticum. Elderberry thickets are common near the lake.

Only a very small percentage of the area is cultivated. The main crops produced thus far upon the Muck within the area considered in this survey are beans, Irish potatoes, eggplant, peppers, cabbage, and tomatoes. Of these, beans are the most extensively grown. Bananas fruit satisfactorily when the moisture supply is abundant. (See Pl. V.) Strawberries are grown to a limited extent on the Muck. Sulphate of potash has been used as a fertilizer, applied when the plants were set out.

At the time of the survey, in February and March, Kentucky bluegrass, English bluegrass, Rhodes grass, Japanese grass, alfalfa, barley, and oats were growing on the Muck.

It is the opinion of truckers that the Muck is especially adapted to the production of cabbage. Large, solid heads of cabbage of good flavor are produced without the use of fertilizer. Onions of the Globe type are successfully grown, yielding under good conditions 400 bushels per acre. Beans have yielded 150 hampers and tomatoes 150 crates per acre.

Sugar cane, sugar beets, and tobacco have been grown, but experience is not yet sufficient to show whether or not they are profitable crops. Avocados grow and fruit well. Young grapefruit and orange trees are growing near the lake, but the present moisture conditions do not seem to be favorable to them. Guavas and papayas are grown.

No special methods of cultivation or fertilization for winter truck crops have been worked out in the limited areas of Muck that have been used. Complete fertilizers are used for practically all crops.

The drainage operations within recent years have so lowered the water table that in seasons of deficient rainfall the moisture supply is a serious problem.

A narrow fringe of loose, poorly drained material, lying along the lake shore and covered with water at times, is indicated on the map by the swamp symbol. It contains more fibrous material than the typical Muck, and under present conditions is of no agricultural value. The native vegetation is chiefly aquatic grasses.

Lands of the typical Muck adjacent to Lake Okechobee are held at $40 to $100 per acre. This does not seem to be an unreasonable price for such land, where transportation and market facilities are available.

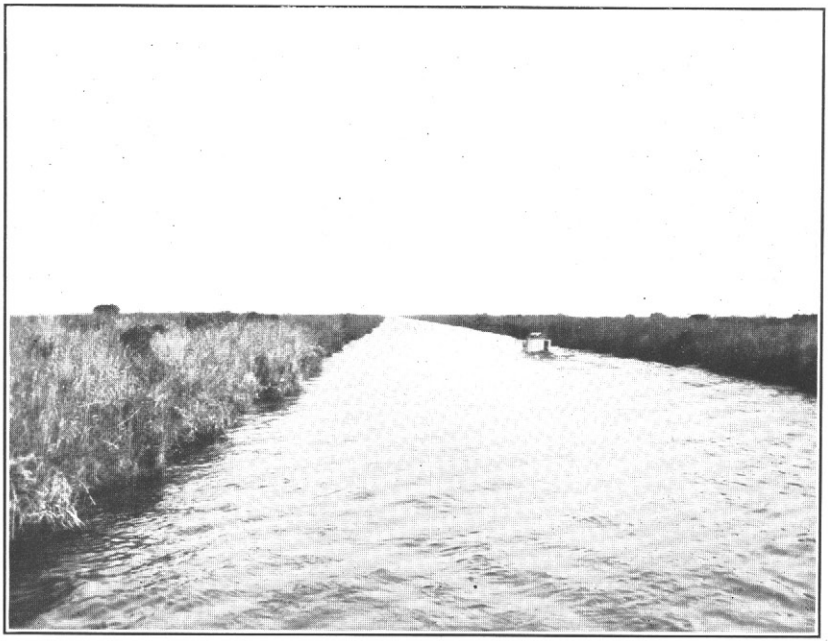


FIG. 1.—VIEW OF THE NORTH NEW RIVER CANAL.

FIG. 2.—BANANAS ON MUCK, SOUTH SHORE OF LAKE OKECHOBEE, NEAR ENTRANCE OF MIAMI CANAL. CUSTARD-APPLE GROWTH IN BACKGROUND.

FIG. 1.—SAW GRASS, TYPICAL VEGETATION ON BROWN FIBROUS PEAT.

FIG. 2.—TYPICAL SAW GRASS NEAR MILEPOST 13.

Muck, shallow phase.—To a depth of 8 to 30 inches the shallow phase of Muck is a black, decomposed, firm muck or peaty muck containing a relatively high percentage of inorganic material. The underlying substratum is limestone or fine quartz sand underlain by limestone. The admixture of inorganic material is more apparent in the areas where the Muck is shallow. In the deeper areas the lower material is in some cases dark-brown peaty muck, less thoroughly decomposed than the typical surface material.

The organic content of two representative samples of this material is indicated in the following table, showing loss on ignition of oven-dried material:

Loss on ignition of oven-dried samples of Muck, shallow phase.

No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*
369	0 to 10	54.2
377	0 to 10	70.3

Areas of the shallow phase of Muck are confined to the eastern part of the area surveyed. They occur in association with the Black nonfibrous peat, and in many cases the boundaries between the two classes of material are entirely arbitrary. A few small areas occur as depressions in the sands of the rock-rim region. The surface is nearly always flat and practically level. Natural drainage is poor, but many of the areas have been artificially drained by ditching.

Most of those areas near the rock rim were forested with cypress, swamp maple, willow, and myrtle. Some of the areas lying in the edge of the Everglades were prairie, with the typical prairie vegetation of the Everglades.

Those areas which have been reclaimed for agriculture by drainage and clearing are used for general trucking purposes. Tomatoes, beans, and potatoes are the main crops grown. Cabbage, eggplant, and peppers are grown to some extent. Corn makes good fodder but no ears.

The truck crops are heavily fertilized. One ton of a $5\frac{1}{2}$–$2\frac{1}{2}$–5 mixture or one higher in potash is applied in three or four applications to tomatoes, which are by far the most important of the truck crops. Some growers use one-half to 1 ton of stable manure to the acre at the time of planting. Two hundred and fifty crates of tomatoes to the acre are considered a good crop.

PEATY MUCK.

The surface material of the Peaty muck, to a depth of 100 to 120 inches, is a dark-brown, soft peaty muck, in which the vegetable matter is partially disintegrated and decomposed. A rather indefinite stratification is noted, layers of black, well-decomposed material 2 to 6 inches thick alternating in places with brown, semifibrous material. Where there is a definite boundary between the upper and lower portions of the organic material two samples were taken for separate analysis. In general the immediate surface material is brown, loose undecomposed vegetable débris, chiefly dead and partially disintegrated leaves, roots, and stems, but there are small areas where the surface material is nearly black and consists of well-decomposed plant remains.

The following table gives the results of ignition of oven-dried samples of the Peaty muck:

Ignition of oven-dried samples of Peaty muck.

No. of sample.	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*		*Inches.*	*Per cent.*		*Inches.*	*Per cent.*
8	0 to 116	80.6	17	0 to 120	77.4	22	0 to 20	78.6
13	0 58	76.8	18	0 62	71.7	22*a*	20 111	35.2
13*a*	58 120	71.1	18*a*	62 106	81.5	28	0 44	82.2
14	0 120	51.8	21	0 112	82.4	28*a*	44 106	87.5

But one area of Peaty muck is mapped. It occupies an irregular strip of territory, one-fourth mile to 2 miles wide, just south of the "custard-apple" region. The surface is flat, with a gentle slope southward. At the time of the survey the water table stood at 12 to 20 inches below the surface in the greater part of the area.

The present vegetation of the Peaty muck is chiefly willow (see Pl. III, fig. 2), with a few scattered clumps of custard apple in the northern part of the area. Moonflower vines, wild buckwheat, some saw grass, ferns, and other herbaceous vegetation constitute the undergrowth. No portion of the area is under cultivation.

Peaty muck, salt water phase.—The salt water phase of Peaty muck differs from the typical material chiefly in being subject to tidal overflow by salt and brackish water. The surface material is a black to dark-brown peaty muck, which is underlain by a dark-brown peaty muck or muck. Sand or marl is in many places encountered in the 3-foot section. The percentage of extraneous mineral matter in the lower portion is usually quite high, and consists of fine sand,

very fine sand, and marl. Ignition of an oven-dried sample gave the following results:

Ignition of oven-dried sample of Peaty muck, salt water phase.

No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*
379	0 to 8	71.2
379*a*	8 36	40.8

The salt water phase of the Peaty muck occupies a portion of the filled-in lagoon lying between the mainland and the coastal bar. The surface is flat and so low that tides periodically cover most of it. The native vegetation is chiefly red mangrove. No portion of the area has been reclaimed for agricultural use. Such reclamation would require diking and pumping.

BROWN FIBROUS PEAT, DEEP OVER LIMESTONE.

Peat soils have everywhere been found difficult to utilize for agriculture. This is indicated by the fact that the peat soils of the world have remained largely unutilized. As notable examples, may be mentioned the peat bogs of Ireland and many of the moor (peat) soils of northern Europe.

Brown fibrous peat, deep over limestone, is the predominant surface material mapped, covering 136,704 acres, or 60.5 per cent of the area, and, while minor variations of color, texture, inorganic content, depth, and character of substratum are to be noted, it is on the whole a remarkably uniform body of material. Typically it consists of brown fibrous to dark-brown semifibrous, slightly decomposed organic matter, underlain by limestone at depths varying from about 36 to 140 inches. In many borings a poorly defined stratification is observed, layers being encountered in the vertical section which consist of black, well-decomposed peat or peaty muck. Generally the material below 3 or 4 feet is darker brown, more thoroughly decomposed, and of higher ash content than the surface peaty material. A microscopic examination [1] of the partially decomposed plant remains indicates that the peat is made up of decaying herbaceous vegetation, probably similar to that growing on the Everglades at the present time. (See Pl. VI.)

The depth of the peat and the character of the underlying rock substratum are variable. From the second milepost below Lake

[1] The authors are indebted to Prof. Charles A. Davis of the U. S. Bureau of Mines for an examination of the plant remains of the Everglades Peat.

Okechobee to the tenth milepost the substratum is limestone, encountered at depths usually ranging from 110 to 130 inches below the surface. From this point toward the ocean the peat gradually becomes thinner until near the eastern boundary of the area it averages about 50 inches in depth. In this lower portion of the Everglades the character of the substratum becomes more variable. In many borings a thin stratum of sand, sandy marl, or marl is encountered lying between the peat and the limestone rock. Where the layer of sand is 10 inches or more in thickness the areas are indicated on the map as a separate phase. In some cases the peat itself contains an admixture of fine quartz sand, often sufficient to increase the ash content to 16 per cent or more of the weight of the dry sample. Where such is the case over extended areas a separation is made on the soil map.

The following table shows the loss on ignition of a number of samples of Brown fibrous peat, deep over limestone:

Loss on ignition of samples of Brown fibrous peat, deep over limestone.

No. of sample.[1]	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven dried sample).
	Inches.	*Per cent.*		*Inches.*	*Per cent.*		*Inches.*	*Per cent.*
15	0 to 112	86.5	45	0 112	88.3	71	0 118	91.8
16	0 50	84.5	46	0 127	91.8	72	0 118	90.0
16*a*	50 124	82.3	47	0 116	91.6	73	0 112	91.1
23	0 120	90.5	48	0 120	90.4	74	0 60	91.1
24	0 112	85.7	49	0 116	90.6	74*a*	60 131	85.6
25	0 136	81.4	50	0 124	86.6	75	0 120	90.5
26	0 102	88.2	51	0 60	91.5	76	0 110	90.7
27	0 44	86.7	51*a*	60 112	82.1	77	0 118	88.3
27*a*	44 107	89.4	52	0 112	89.3	78	0 60	91.7
29	0 124	85.5	53	0 114	86.5	78*a*	60 118	87.4
30	0 50	85.7	54	0 113	88.6	79	0 60	92.2
30*a*	50 70	54.7	55	0 115	91.0	79*a*	60 120	90.0
30*b*	70 116	79.6	56	0 116	88.9	80	0 60	91.6
31	0 116	91.1	57	0 128	89.2	80*a*	60 124	84.1
32	0 132	88.0	58	0 106	88.7	81	0 118	88.2
33	0 30	88.1	59	0 113	88.9	82	0 50	93.5
33*a*	30 128	91.4	60	0 110	89.1	82*a*	50 124	87.8
34	0 116	90.7	61	0 117	89.0	83	0 124	88.1
35	0 105	89.2	62	0 121	88.6	84	0 102	89.9
36	0 131	88.0	63	0 104	91.0	85	0 115	89.1
37	0 126	87.7	64	0 110	91.7	86	0 114	88.0
38	0 131	82.0	65	0 108	90.0	87	0 44	91.0
39	0 114	91.9	66	0 112	91.9	87*a*	44 132	89.3
40	0 115	87.0	67	0 116	90.0	88	0 50	92.3
41	0 124	93.6	68	0 60	93.3	88*a*	50 124	88.9
42	0 114	87.7	68*a*	60 147	88.9	89	0 130	90.9
43	0 127	90.8	69	0 50	93.3	90	0 126	88.1
44	0 50	89.4	69*a*	50 130	90.0	91	0 124	91.7
44*a*	50 123	83.8	70	0 112	91.5	92	0 99	90.0

[1] The location of these samples can be determined upon reference to the accompanying soil map.

Loss on ignition of samples of Brown fibrous peat, deep over limestone—Continued.

No. of sample.	Depth.		Loss on ignition (oven-dried sample).	No. of sample.	Depth.		Loss on ignition (oven-dried sample).	No. of sample.	Depth.		Loss on ignition (oven dried sample).
	Inches.		*Per cent.*		*Inches.*		*Per cent.*		*Inches.*		*Per cent.*
93	0	106	88.1	124	0	40	89.5	152	0	35	91.3
94	0	100	91.3	124*a*	40	104	87.2	152*a*	35	94	89.7
95	0	108	90.7	125	0	42	91.0	153	0	29	91.3
96	0	114	86.3	125*a*	42	105	89.8	153*a*	29	72	88.6
97	0	50	93.7	126	0	97	89.0	154	0	30	93.5
97*a*	50	134	88.4	127	0	39	91.2	154*a*	30	91	90.4
98	0	127	87.1	127*a*	39	84	87.8	155	0	25	91.8
99	0	32	91.8	128	0	38	91.4	155*a*	25	82	88.1
99*a*	32	118	87.5	128*a*	38	95	88.8	156	0	28	92.8
100	0	96	87.5	129	0	39	92.9	156*a*	28	76	88.1
101	0	110	88.1	129*a*	39	100	88.8	157	0	41	90.9
102	0	102	88.7	130	0	38	92.5	157*a*	41	84	89.9
103	00	116	88.0	130*a*	38	100	90.4	158	0	40	93.0
104	0	37	92.9	131	0	43	92.6	158*a*	40	100	88.4
104*a*	37	108	88.4	131*a*	43	101	89.1	159	0	36	92.3
105	0	40	93.9	132	0	38	91.3	159*a*	36	80	89.9
105*a*	40	111	88.4	132*a*	38	86	89.1	160	0	34	93.0
106	0	140	90.0	133	0	35	90.0	160*a*	34	91	89.8
107	0	30	93.0	133*a*	35	90	89.9	161	0	25	93.4
107*a*	30	130	89.8	134	0	35	91.0	161*a*	25	78	90.4
108	0	48	90.0	134*a*	35	90	89.2	162	0	38	92.0
108*a*	48	107	86.3	135	0	44	91.4	162*a*	28	76	87.4
109	0	58	91.8	135*a*	44	98	90.0	163	0	28	91.6
109*a*	58	99	88.6	136	0	44	91.0	163*a*	28	70	87.8
110	0	40	90.3	136*a*	44	96	87.4	164	0	38	91.6
110*a*	40	96	88.0	137	0	40	92.5	164*a*	38	90	89.4
111	0	24	89.1	137*a*	40	88	87.9	165	0	28	93.5
111*a*	24	110	91.0	138	0	38	91.6	165*a*	28	89	91.0
112	0	40	92.6	138*a*	38	96	89.6	166	0	30	92.2
112*a*	40	120	86.6	139	0	38	92.2	166*a*	30	78	89.1
113	0	40	92.8	139*a*	38	82	90.3	167	0	25	92.7
113*a*	40	120	90.0	140	0	39	91.0	167*a*	25	78	90.7
114	0	40	91.3	140*a*	39	112	89.2	168	0	39	92.3
114*a*	40	90	88.7	141	0	89	91.2	168*a*	39	80	87.8
115	0	102	89.9	142	0	40	92.3	169	0	78	90.3
116	0	18	89.7	142*a*	40	87	83.1	170	0	40	90.6
116*a*	18	54	8.96	143	0	30	93.4	170*a*	40	74	87.8
116*b*	54	90	87.0	143*a*	30	96	90.0	171	0	38	90.8
117	0	30	91.3	144	0	78	91.1	171*a*	38	88	86.5
117*a*	30	102	87.1	145	0	38	91.8	172	0	87	90.0
118	0	39	92.0	145*a*	38	72	88.5	173	0	75	88.1
118*a*	39	107	87.2	146	0	40	89.4	174	0	30	92.2
119	0	37	90.0	146*a*	40	96	86.6	174*a*	30	66	87.9
119*a*	37	96	88.5	147	0	93	88.8	175	0	37	91.5
120	0	40	90.7	148	0	30	93.1	175*a*	37	72	88.1
120*a*	40	88	89.3	148*a*	30	86	86.9	176	30	68	89.1
121	0	40	90.3	149	0	26	92.1	177	0	82	90.0
121*a*	40	98	87.2	149*a*	26	103	86.5	178	0	81	90.0
122	0	30	91.3	150	0	37	92.1	179	0	20	92.9
122*a*	30	90	88.6	150*a*	37	80	89.2	179*a*	20	72	88.5
123	0	40	92.0	151	0	39	91.0	180	0	33	93.3
123*a*	40	90	89.5	151*a*	39	96	88.2	180*a*	33	60	86.7

Loss on ignition of samples of Brown fibrous peat, deep over limestone—Continued.

No. of sample.	Depth.		Loss on ignition (oven-dried sample).	No. of sample.	Depth.		Loss on ignition (oven-dried sample).	No. of sample.	Depth.		Loss on ignition (oven-dried sample).
	Inches.		*Per cent.*		*Inches.*		*Per cent.*		*Inches.*		*Per cent.*
181	0	66	90.4	210	0	48	90.8	251	0	42	87.8
182	0	37	91.3	211	0	48	88.4	252	0	82	87.9
182*a*	37	75	88.3	212	0	54	87.7	254	0	42	87.0
183	0	73	86.4	213	0	26	93.0	255	0	43	93.3
184	0	74	91.1	213*a*	26	46	79.3	258	0	26	93.1
185	0	75	91.3	214	0	56	86.6	258*a*	26	58	58.4
186	0	63	89.3	215	0	28	93.2	259	0	71	87.4
187	0	69	91.5	215*a*	28	55	88.8	261	0	66	90.3
188	0	34	91.1	216	0	42	82.3	262	0	18	89.9
188*a*	34	64	89.0	217	0	22	93.6	264	0	52	90.0
189	0	66	91.8	217*a*	22	54	84.0	265	0	36	80.0
190	0	60	90.1	218	0	50	69.2	266	0	54	88.0
191	0	62	91.7	219	0	18	86.1	268	0	45	92.3
192	0	63	90.5	219*a*	18	58	67.8	270	0	64	87.0
193	0	62	90.0	220	0	58	90.5	271	0	80	88.6
194	0	30	91.0	221	0	20	93.0	273	0	36	89.2
194*a*	30	72	88.8	221*a*	20	61	87.2	273*a*	36	66	26.6
195	0	20	92.9	222	0	58	90.1	276	0	36	88.0
195*a*	20	65	86.0	223	0	52	88.5	276*a*	36	61	80.0
196	0	72	91.6	224	0	53	88.5	277	0	54	88.0
197	0	72	92.0	225	0	63	90.7	279	0	82	86.0
198	0	58	91.4	226	0	46	88.7	280	0	42	85.0
199	0	54	90.5	227	0	70	85.8	284	0	100	91.0
200	0	60	91.5	228	0	30	82.2	286	0	48	88.0
201	0	58	91.9	229	0	40	88.5	288	0	36	90.0
202	0	23	93.2	233	0	64	89.3	288*a*	36	68	87.0
202*a*	23	64	88.8	234	0	40	89.0	291	0	24	87.6
203	0	32	90.2	238	0	59	92.1	291*a*	24	58	81.5
203*a*	32	70	88.5	239	0	45	84.8	293	0	78	90.0
204	0	45	89.4	240	0	52	90.7	295	0	72	92.0
205	0	67	90.8	242	0	44	91.0	296	0	51	93.0
206	0	30	86.3	242*a*	44	68	43.4	298	0	47	91.0
206*a*	30	58	89.9	244	0	29	91.8	299	0	48	88.0
207	0	51	88.7	245	0	36	92.5	300	0	54	85.7
208	0	57	90.9	246	0	56	90.0	303	0	54	88.0
209	0	18	93.4	247	0	34	90.6	305	0	44	90.0
209*a*	18	71	73.5								

The Brown fibrous peat, deep over limestone, is typically developed in one large area, extending from an irregular boundary within 2 or 3 miles of Lake Okechobee to the thirty-second milepost below the lake on the North New River Canal. Below the thirty-second milepost the admixture of quartz sand becomes sufficient to warrant a phase separation, and the underlying substratum is in places sand instead of limestone. These phases become predominant at about the forty-sixth milepost, and no area of the typical Brown fibrous peat, deep over limestone, is mapped below the fiftieth milepost.

The surface of the upper part of the large area of this type is flat and nearly level. No natural drainage channels are apparent, and the flatness is broken only by infrequent alligator holes and runways. The elevation near the cross canal 4 miles south of the lake is about 20 feet above sea level. As the coast is approached the topography changes somewhat. A series of ridges and sloughs trending in a northwest-southeast direction is apparent, with local differences in elevations of 2 to 3 feet. The altitude above sea level gradually decreases, and at the forty-sixth milepost it is about 10 feet. The drainage conditions over this area are shown on the water-table map accompanying the report (Pl. A). A comparatively small proportion near the canal is sufficiently drained for agricultural purposes. At the time of the survey in about 68 per cent of the area of the typical material either the water table lay at the surface or the land was under water to a maximum depth of 38 inches. Under 32 per cent of the area the water table lay from 2 to 24 inches below the surface.

Immediately adjacent to the cross canal the water table at the time the survey was made was 24 inches below the surface. In fibrous material of this kind this is too deep for seed bed, and most growing crops suffer for lack of moisture except in rainy seasons.

The drainage of the main body of this type is proceeding through the construction of main drainage canals and cross canals, but it is generally believed that after the canals have been completed provision will have to be made for locks to regulate the flow so as to maintain the level of ground water at the optimum depth for crops and to guard against excessive drainage. So far as is known the present drainage plans make no provision for connecting the individual tracts lying at a distance from the canals with any of the main canals.

A few settlers have established homes in the vicinity of the cross canal, and have planted small areas to beans, cabbage, potatoes, turnips, radishes, lettuce, and bananas. The freezes of the winter of 1914–15 killed most of the growing crops, and experience has not been sufficient to furnish a basis for statements regarding yields and fertilizer requirements.

The dense growth and character of the native vegetation makes it difficult to bring this land in proper condition for agricultural use. The roots of the saw grass and lilies are especially difficult to remove, and various machines have been devised and are being used to do this work.

It appears that the frost during the winter season will prevent the profitable growing on this type of soil of tender vegetables in winter, a profitable winter trucking, and such special crop use as is peculiar to the soils and climate of southern Florida. It is also believed by

many of the people interested in the development of this section of the Everglades that the most favorable possibility for its agricultural utilization will be found in the raising and grazing of live stock.

It is such land as this, untried for agriculture, and a large proportion of it at present under water, that, as mentioned in the chapter on Agriculture, is being sold for $20 to $65 an acre.

BROWN FIBROUS PEAT, DEEP OVER SAND.

The separation of the material mapped as Brown fibrous peat, deep over sand, is based upon the character of the underlying substratum. In color, texture, and depth the organic material is practically identical with that of adjacent areas of the typical Brown fibrous peat, deep over limestone. It is a brown fibrous or dark-brown semifibrous peat, 36 to 80 inches in depth, underlain by fine sand, which forms a stratum 10 or more inches thick over the limestone.

The organic material is fairly uniform in color and texture throughout the vertical section, but in several borings layers 2 to 6 inches thick of black, decomposed Peat are encountered. In some borings there are sufficient differences to warrant taking two samples.

The following table indicates the percentage of loss on ignition of oven-dried samples:

Loss on ignition of oven-dried samples of Brown fibrous peat, deep over sand.

No. of sample.	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*		*Inches.*	*Per cent.*		*Inches.*	*Per cent.*
315	0 12	89.0	330	0 to 46	86.6	342	0 8	91.6
315*a*	12 54	74.5	331	0 54	92.0	342*a*	8 to 48	86.0
317	0 40	90.0	332	0 80	90.0	343	0 46	87.6
320	0 48	91.0	333	0 54	90.0	344	0 44	92.6
323	0 28	89.3	334	0 8	92.4	346	0 8	91.2
323*a*	28 48	78.0	334*a*	8 40	92.0	346*a*	8 36	88.4
326	0 28	92.0	338	0 15	91.0	347	0 8	91.0
327	0 42	90.0	338*a*	15 38	86.8	347*a*	8 48	91.0
328	0 40	82.6	339	0 46	89.1	348	0 8	90.0
329	0 30	92.0	341	0 8	83.1	348*a*	8 64	93.0
329*a*	30 40	81.0	341*a*	8 48	91.7	354	0 50	90.7

With the exception of a few very small areas, the main body of this phase lies between mileposts 47 and 53 and comprises the greater part of this section of the area surveyed.

The greater proportion of the phase was covered with shallow water at the time of the survey. Near the South New River Canal, however, and east of "Pine Island" between the canals, the water table

is below the surface. A few small areas adjacent to the South Canal are under cultivation. Bananas, potatoes, tomatoes, cabbage, and beans have been grown with some success. The varieties grown, fertilizers used, and cultural methods are similar to those in adjoining areas of Black nonfibrous peat.

BROWN FIBROUS PEAT, SHALLOW OVER SAND (12 TO 36 INCHES).

To a depth of 12 to 36 inches the material mapped as Brown fibrous peat, shallow over sand (12 to 36 inches), consists typically of a brown, fibrous to semifibrous peat. The underlying material is fine quartz sand, which is in turn underlain by rock at 6 to 10 feet below the surface. The ash content of the typical samples of this phase varies from 7 to 16 per cent.

The following table gives the results on ignition of oven-dried samples of this phase:

Ignition of oven-dried samples of Brown fibrous peat, shallow over sand (12 to 36 inches)

No. of sample.	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*		*Inches.*	*Per cent.*
345	0 to 15	87.0	352	0 to 18	93.0
349	0 32	92.0	352*a*	18 24	63.0
350	0 29	85.5	353	0 18	91.0

Three areas are classified as of this phase. They are located in the eastern part of the Everglades, one north of the North New River Canal, and two between the North Canal and the South Canal. The topography is generally flat, with the minor variations of ridges and sloughs characteristic of this section of the Everglades. At the time of the survey the areas lying south of the North Canal were for the most part above water, but the area north of the canal was largely under water, 1 to 20 inches deep.

The native vegetation shows three well-defined groups. The higher, better drained ridges support a rather heavy growth of myrtle and cypress, with a scattering of wild fig and sweet bay, and an entanglement of bamboo briers. In the moderately wet areas, where the water is very near the surface or 1 to 3 inches deep over the surface, the vegetation is chiefly saw grass and hydrophitic grasses. The deeper sloughs are characterized by water lilies and bonnets. This phase is not used for agriculture.

BROWN FIBROUS PEAT, SANDY PHASE, DEEP OVER LIMESTONE.

The Brown fibrous peat, sandy phase, deep over limestone, is distinguished in having scattered through the organic material sufficient fine quartz sand to raise the amount of ash above 15 per cent. The sand is more noticeable in the lower portions, but occurs to some extent in the surface material. The average depth is about 40 inches. The underlying substratum is usually limestone. Fine quartz sand or marl mixed with sand is encountered in some borings as an intervening layer between the peat and the limestone.

The following table gives the loss on ignition of oven-dried samples of this phase:

Loss on ignition of oven-dried samples of Brown fibrous peat, sandy phase, deep over limestone.

No. of sample.	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven-dried sample)
	Inches.	*Per cent.*		*Inches.*	*Per cent.*		*Inches.*	*Per cent.*
230	0 to 45	80.8	260	0 to 64	50.0	290	0 to 60	58.0
231	0 44	82.2	263	0 70	64.4	292	0 78	83.0
231a	44 52	44.8	267	0 60	82.1	294	0 66	74.6
232	0 24	78.2	269	0 88	82.5	297	0 59	43.0
235	0 32	75.5	272	0 66	76.0	301	0 60	67.3
236	0 30	71.9	274	0 48	79.2	302	0 56	61.0
237	0 41	79.1	275	0 68	74.4	306	0 54	84.0
241	0 37	65.3	278	0 76	83.0	307	0 64	81.0
243	0 14	79.7	281	0 90	63.5	309	0 40	64.0
248	0 17	83.6	282	0 60	80.0	310	0 20	81.0
249	0 60	83.0	283	0 54	63.5	311	0 20	64.0
253	0 38	79.9	285	0 78	80.0	312	0 36	76.0
256	0 46	81.8	287	0 60	81.0	316	0 36	67.0
257	0 54	80.2	289	0 40	77.0			

This phase occurs in the lower glades below the thirtieth milepost from Lake Okechobee. It is mapped in scattered areas. Nearer the locks the sand substratum thickens and becomes the more prominent feature of the underlying material. This portion of the Everglades is marked by low ridges and sloughs with a general northwest-southeast trend. There is a marked current of the water in the sloughs moving in a southeasterly direction, and it is probable that the sand owes its distribution in part to the movement of water.

At the time of the survey a few of the higher ridges were above water, but in general the entire surface was inundated. The water in the sloughs in many cases was 2 to 3 feet deep. No agricultural use is made of this phase.

BROWN FIBROUS PEAT, SANDY PHASE, DEEP OVER SAND.

Areas of sandy Brown fibrous peat in which there is a substratum of sand 10 or more inches thick intervening between the peat and limestone are indicated on the soil map. In physical and chemical characteristics, topography, drainage conditions, and vegetation this phase is similar to the sandy Brown fibrous peat over limestone. It occurs associated with that phase in the eastern portion of the Fort Lauderdale area. In every case the boundaries are entirely arbitrary, it being impossible to indicate accurately all local variations in sand content and character of substratum.

The following table gives the loss on ignition of oven-dried samples of this phase:

Loss on ignition of oven-dried samples of Brown fibrous peat, sandy phase, deep over sand.

No. of sample.	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*		*Inches.*	*Per cent.*
308	0 to 82	51.0	319	0 to 48	90.0
313	0 36	70.0	322	0 48	77.6
314	0 40	77.0	324	0 44	83.1
318	0 40	56.6	325	0 47	81.0

BROWN FIBROUS PEAT, SANDY PHASE OVER SAND (12 TO 36 INCHES).

The Brown fibrous peat, sandy phase over sand (12 to 36 inches), differs from the typical shallow peat over sand only in the higher ash content, due to the admixture of fine quartz sand, as indicated in the following table:

Loss on ignition of Brown fibrous peat, sandy phase over sand (12 to 36 inches).

No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*
351	0 to 18	80.0
360	0 18	72.7
372	0 18	67.7

The one area of this phase mapped is in the eastern edge of the Everglades associated with the typical shallow peat over sand. That portion of the area near the canal was at the time of the survey above water, with the water table within a few inches of the surface, but most of it was covered with shallow water. No agricultural use is made of this area.

BROWN FIBROUS PEAT, SANDY PHASE OVER SAND (2 TO 12 INCHES).

Brown fibrous peat, sandy phase over sand (2 to 12 inches), is separately mapped on the basis of difference in depth of the organic material. In physical characteristics it is similar to the deeper sandy peat, but under cultivation the underlying sand becomes mixed with the surface material to form a very sandy peat.

Under present conditions the sand content is very high as indicated by the following results of ignition of a typical sample:

Loss on ignition of sample of Brown fibrous peat, sandy phase over sand (2 to 12 inches).

No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*
376	0 to 7	21

One large area of this phase is indicated on the soil map. It lies north of the North New River Canal, 5 to 6 miles west of Fort Lauderdale. The surface is nearly level, and at the time of the survey was mainly covered with shallow water.

The vegetation is chiefly aquatic grasses, saw grass, and stunted cypress, with clumps of larger cypress, myrtle, sweet bay, and wild fig on small islands. A small area about one-half mile northwest of milepost 56 is under cultivation. It has been used for the production of tomatoes.

Laterals have been dug to the main canal, and by planting on ridges reasonably good drainage is obtained. The crop is planted and fertilized as described in the chapter on agriculture. From 100 to 300 crates per acre of tomatoes is considered a good crop for the first year. It is said by truckers that the soil declines in productiveness with continuous cropping, the decrease in yields being quite noticeable the second year.

BLACK NONFIBROUS PEAT, DEEP OVER SAND.

The Black nonfibrous peat, deep over sand, to a depth of 8 to 24 inches is a dark-brown to black decomposed nonfibrous to semifibrous peat showing in places some slight admixture of fine quartz sand. (See Pl. VII.) This is underlain by brown to dark-brown semifibrous to fibrous peat, which extends to a depth of 36 inches or more. The substratum is fine quartz sand which occurs as a layer of varying thickness over limestone.

The following table gives the loss on ignition of oven-dried samples of this phase:

Loss on ignition of oven-dried samples of Black nonfibrous peat, deep over sand.

No. of sample.	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*		*Inches.*	*Per cent.*		*Inches.*	*Per cent.*
341	0 to 8	83.1	361*a*	26 to 54	90.7	370	0 to 8	78.7
341*a*	8 48	91.7	362	0 8	88.1	370*a*	8 36	87.5
361	0 26	93.0	362*a*	8 36+	91.4	375	0 36+	84.4

The Black nonfibrous peat, deep over sand, is confined to the eastern part of the Everglades, the largest area lying in the neighborhood and east of Davie. Smaller areas are mapped between the two canals east of Pine Island.

The surface is flat and the natural drainage poor, but a large part of the area has been sufficiently drained by artificial methods to permit cultivation. This is especially true of what is known as the Davie Tract. Here an elaborate system of dikes and ditches with a pumping station near the South Canal has been designed not only to drain the land but to keep the water table at the optimum depth for plant growth. Upon this Black nonfibrous peat and the adjoining areas identical with it except for the depth to sand there have been carried on more extensive farming and trucking operations than in any other portion of this section of the Everglades. The following information in regard to the agricultural development of these areas was obtained from men who have had actual experience in handling this land and from observation in the field:

The production of citrus fruits on this black peat is still in the experimental stage. Young trees of several varieties of grapefruit and orange near Davie appear to be making satisfactory growth. Experience indicates that the most satisfactory stock is sour orange and grapefruit. Hardwood ashes and limestone have been used as fertilizer on the young trees, with the indication that, as they begin to bear, potash will be required for successful fruiting. Of the other subtropical fruits of importance, guavas, avacados, papayas, and Japanese persimmons do fairly well. Bananas, of the Cavendish, Ladyfinger, Jamaica, and other varieties, fruit satisfactorily when the water supply is sufficient and freezes do not kill the plants. Of the vegetable and root crops the most important at present are potatoes, beans, eggplant, peppers, and tomatoes, produced as winter truck crops for northern markets. (See Pl. VIII, figs. 1 and 2.) For potatoes 800 to 1,500 pounds of complete fertilizer rich in potash is com-

monly used, an 8–2½–10 mixture being one of the most satisfactory. It is applied in either one or two applications. Two hundred and fifty hampers of potatoes per acre are considered a good yield.

Beans are grown as a winter truck crop, yielding under good conditions 300 hampers per acre. Land for this crop is heavily fertilized with an 8–3–6 mixture or one even higher in potash. Peppers and eggplant are grown to some extent, and 1 to 1½ tons of complete fertilizer analyzing 6–4–6 to 6–4–3 is used for these crops, applied four or five times during the growing and fruiting of the plants.

Experience has shown that tomatoes are not grown as satisfactorily upon the Peat areas as upon the sandy and shallow Muck soils nearer Fort Lauderdale and Dania. The danger from frost is greater, and the plants tend to make vine rather than fruit. Celery is a promising crop and gives good returns when heavily fertilized. Two tons to the acre of a 5½–8–4 mixture has been used with good results. One ton of the fertilizer is applied at planting; the remainder is worked in during the cultivation of the crop. Cabbage and onions are grown successfully with relatively small applications of fertilizer, but market conditions are not generally favorable to the profitable sale of these crops, especially onions.

Sweet potatoes yield satisfactorily and do not require fertilizer when they follow crops for which the land has been fertilized heavily. Vegetables of minor importance which have been grown near Davie are okra, Hawaiian yams, Honduran yams, cassava, and dasheens.

Of the forage crops and grasses, Japanese cane, Para grass, Rhodes grass, Bermuda grass, St. Augustine grass, and cowpeas do well. Kentucky bluegrass can be grown, but the sod is not firm enough to stand trampling. Nassau corn is grown in small patches, yielding 25 to 40 bushels per acre.

Australian pines grow rapidly and serve as excellent windbreaks. Some varieties of eucalyptus make rapid growth but the oil varieties do not seem to do well.

Weeds are not particularly troublesome if cultural methods are carried on intensively. Maiden cane is perhaps the most difficult to kill out. Fennel and "careless weed" grow luxuriantly in abandoned fields.

Where the native vegetation consists of clumps of myrtle, clearing involves some difficulty, and is somewhat more expensive than the subduing of the saw grass and maiden cane of the open prairie.

BLACK NONFIBROUS PEAT, DEEP OVER LIMESTONE.

To a depth of 10 to 15 inches the Black nonfibrous peat, deep over limestone, consists of a black to dark brown nonfibrous to semifibrous peat, showing but little trace of the original vegetable tissue. In places

there appears to be an admixture of extraneous inorganic material, as in sample No. 371, the surface material of which shows 18.5 per cent of ash. The underlying organic matter is usually less thoroughly decomposed than is the surface material, being brown and fibrous to semifibrous. Inorganic material, mainly fine sand, is present here in varying quantities. The samples tested showed loss on ignition as follows:

Loss on ignition of samples of Black nonfibrous peat, deep over limestone.

No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*
366	0 to 10	93.0
366a	10 100	86.0
371	0 12	81.5
371a	12 60	54.6

But one area of this phase, 2 miles northeast of Davie, is mapped. The surface is nearly level, but practically all of the area is free from standing water. A few small tracts near the canal are used for trucking. The crops grown, yields, and cultural methods are similar to those on the Black nonfibrous peat, deep over sand.

BLACK NONFIBROUS PEAT, TIMBERED PHASE.

The Black nonfibrous peat, timbered phase, is separated from the areas of similar material on the basis of its native vegetation. To a depth of 10 to 14 inches it consists of a black, well-decomposed nonfibrous peat to peaty muck with some admixture of fine quartz sand. This is underlain by dark-brown semifibrous to brown fibrous peat. The substratum is limestone or quartz sand, encountered at depths ranging from 36 to 100 inches.

The following table shows the loss on ignition of samples of this phase:

Loss on ignition of Black nonfibrous peat, timbered phase.

No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*
367	0 to 14	73.6
367a	14 38	86.7
374	0 12	85.3
374a	12 50	93.2

All the areas of this phase are located in the eastern section of the Everglades southwest of Fort Lauderdale. They occur generally along the river and have in places been subject to overflow in former years. This overflow has brought in small quantities of extraneous mineral matter, chiefly quartz sand, which is apparent in some places. The topography is low and flat, and in places swampy. The native vegetation consists mainly of cypress, cabbage palmetto, swamp maple, bay, and myrtle with an undergrowth of ferns, notably agrosticum.

But a small proportion of this phase is under cultivation, poor drainage precluding agricultural operations over most of the area. Where cultivated the crop adaptations and cultural methods are similar to those of the deep prairie phases of the Black nonfibrous peat. The expense of clearing is greater, however, much labor being involved in the removal of the large trees and heavy undergrowth.

BLACK NONFIBROUS PEAT, SHALLOW OVER SAND.

The Black nonfibrous peat, shallow over sand, to a depth of 8 to 15 inches is a black, nonfibrous, decomposed peat with little or no admixture of extraneous inorganic material. The subsurface material is a brown fibrous to semifibrous Peat, underlain by fine quartz sand at 36 inches or less. This underlying sand is a surficial layer over limestone which is in places within 4 or 5 feet of the surface.

The following table indicates the organic content of this phase, showing the loss on ignition of oven-dried samples:

Loss on ignition of oven-dried samples of Black nonfibrous peat, shallow over sand.

No. of sample.	Depth.	Loss on ignition (oven-dried sample).	No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*		*Inches.*	*Per cent.*
340	0 to 8	88.0	356	0 to 8	87.4
340*a*	8 36	91.8	356*a*	8 24	42.1
355	0 8	91.3	357	0 22	73.5
355*a*	8 24	80.8	358	0 20	88.4

Areas of this phase are restricted to the eastern portion of the area. They occur north and west of Davie associated with areas of the deep phases of the Black nonfibrous peat.

The topography is nearly flat. Natural drainage is poor, but ditching has lowered the water table below the surface over practically all the phase.

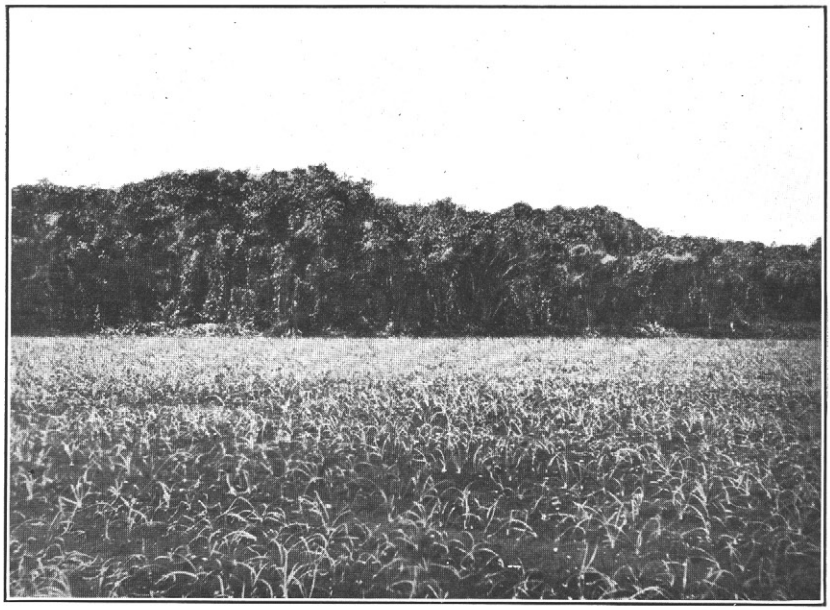
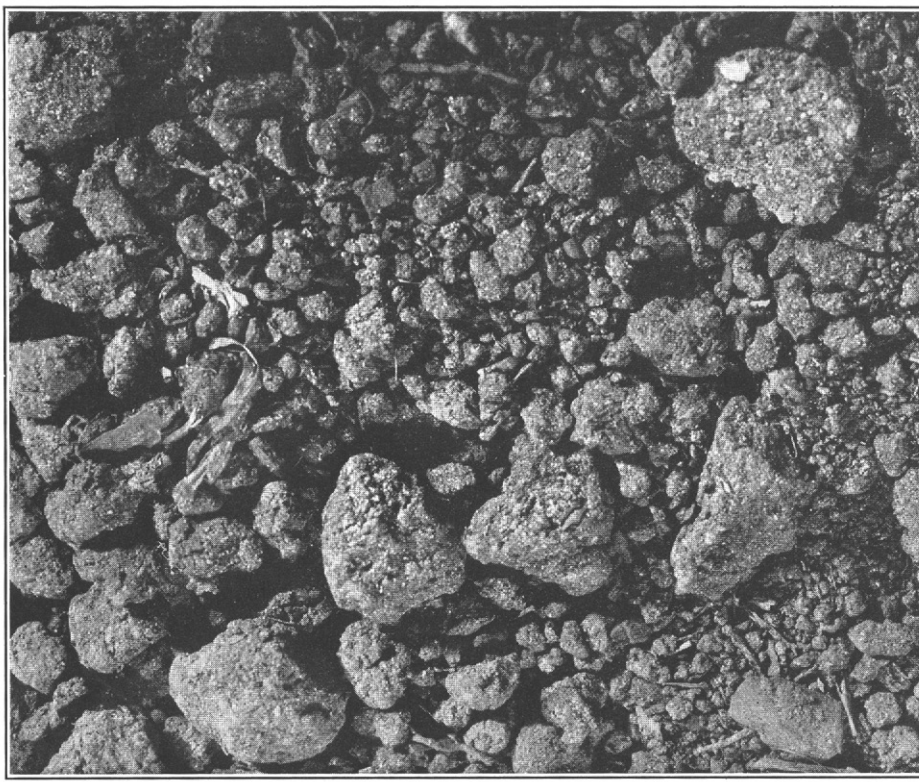


FIG. 1.—ONIONS ON MUCK. CUSTARD APPLE IN BACKGROUND. SOUTH SHORE OF LAKE OKECHOBEE.

FIG. 2.—WILLOWS ON PEATY MUCK, WEST BANK OF NORTH NEW RIVER CANAL, 2½ MILES SOUTH OF LAKE OKECHOBEE.



MUCK.

The nonfibrous character and relatively firm mineral texture of the muck, due to the presence of fine san
of the "custard-apple" region of the shores of Lake Okechobee, is indicated in the ill

BROWN FIBROUS PEAT.

The light, fibrous or felty character and corky texture of the Brown fibrous peat, representative miles of the Everglades, can be seen in this illustration.

BLACK NONFIBROUS PEAT.

This soil lacks the mineral constituents of the Muck and the fibrous, felty, and corklike texture of the Brow
and pulverized, as in the sample photographed, the difference in character is clearly ind

FIG. 1.—BEANS ON BLACK NONFIBROUS PEAT.

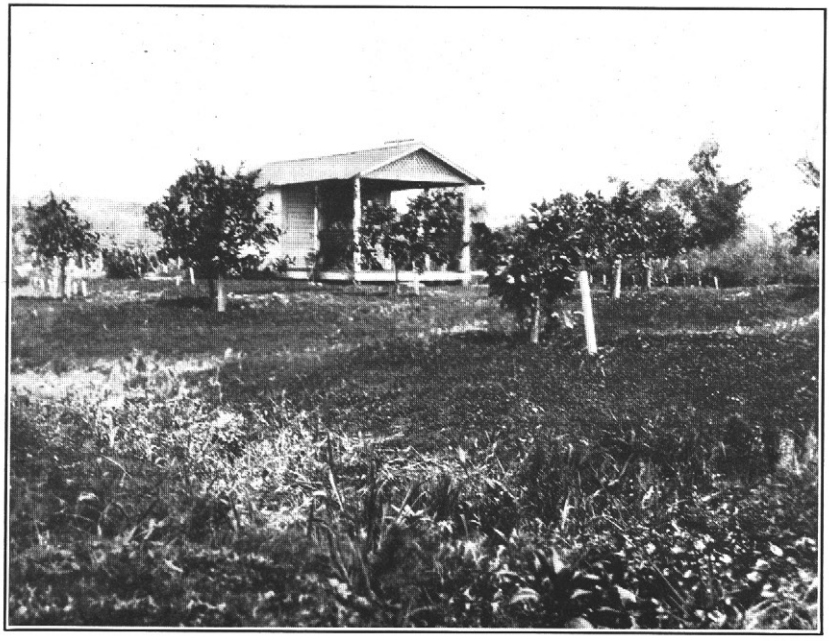


FIG. 2.—CITRUS TREES ON BLACK NONFIBROUS PEAT.

The present natural vegetation is chiefly saw grass and maiden cane, with scattered clumps of myrtle. Fennel and "careless weed" grow luxuriantly in abandoned fields.

The agricultural operations on this phase are identical with those on the deep phase over sand of the Black nonfibrous peat.

BLACK NONFIBROUS PEAT, CYPRESS ISLAND PHASE.

The segregation of Black nonfibrous peat, cypress island phase, is based on topography and vegetation rather than upon any particular characteristic of the organic material. Most of the area is open prairie. Here the surface material is brown fibrous peat underlain by fine quartz sand at about 20 inches. Scattered irregularly throughout the area are small "islands" ranging in size from a few square rods to 10 acres or more which are 12 to 24 inches above the general surface of the prairie. The surface material of the "islands" is usually black, decomposed peat or peaty muck to a depth of 8 to 15 inches. This is underlain by brown peat, and at greater depths fine sand is encountered.

These islands are usually above water, while the lower areas are inundated, and the vegetation consists of cypress, bay, wild fig, and myrtle, with bamboo briers, as contrasted with the aquatic grasses and water lilies of the prairie.

The following table shows loss on ignition of samples of this phase:

Loss on ignition of oven-dried samples of Black nonfibrous peat, cypress island phase.

No. of sample.	Depth.	Loss on ignition (oven-dried sample).
	Inches.	*Per cent.*
359	0 to 12	91.0
359a	12 20	84.9
373	0 10	93.0
373a	10 20	62.4
380	0 18	88.3

But one area of the cypress island phase is mapped. It occurs north of the North New River Canal, about 6 miles west of Fort Lauderdale. Because of unfavorable drainage conditions, no agricultural use has been made of this phase.

SUMMARY.

The Fort Lauderdale area, Florida, consists of a strip of territory 5 to 7 miles in width extending from the Atlantic Ocean, east of Fort Lauderdale, along the North New River Canal to Lake Okechobee. The total area is 352.5 square miles, of which a large percentage is within the Everglades.

The topography is generally flat and nearly level, the elevation ranging from sea level to about 21 feet.

Natural drainage over most of the area is entirely inadequate, the only well-drained portion being near the coast. Artificial drainage is being undertaken on a large scale, and a portion of the area has been drained sufficiently for agricultural purposes.

The population is chiefly urban, Fort Lauderdale and Dania being the most important towns in the area. For a distance of more than 45 miles along the North New River Canal there is no settlement whatever. Transportation facilities are furnished by the waterways and the Florida East Coast Railway.

The climate is subtropical and generally equable and mild, but there are noticeable local variations which influence agriculture. Frosts are much more frequent and severe during the winter in the interior of the Everglades portion of the area surveyed than upon the forelands of Lake Okechobee and the Atlantic Ocean.

The agricultural development in the Fort Lauderdale area has taken place within the past 20 years. The growing of winter truck crops for the northern markets is the predominant agricultural industry. Oranges and grapefruit are grown to some extent.

The soils of the area are divided into two main groups—the cumulose soils and the soils derived from marine sediments. The former consist chiefly of organic material in various stages of disintegration and decay, with an admixture of varying quantities of extraneous inorganic material. The cumulose material is classified as Muck, Peaty muck, and various phases of Peat. The soils derived from marine sediments are chiefly fine quartz sands, with an admixture of varying quantities of organic matter. The bedrock is everywhere limestone. In places its surface is within the 3-foot vertical section, and such areas are separately indicated on the soil map.

The Palm Beach sand occurs on the coastal bar near the ocean. It consists of a mixture of fragments of shells and quartz sand, with some disintegrated organic material in the surface few inches. The type is well drained, but is not used for agriculture to any extent. It is well adapted to coconuts.

The St. Lucie fine sand is a light-gray to white fine quartz sand with a slight admixture of organic matter in the immediate surface material. The typical soil is excessively drained on account of its slightly

elevated position and its extremely porous structure. A phase is mapped which is nearly flat but fairly well drained. A poorly drained phase is shown to include areas which are flat, low, and poorly drained. The typical St. Lucie fine sand is not used for agriculture; the flat and poorly drained phases are used to some extent for trucking.

The Plummer fine sand is a fine quartz sand with sufficient organic matter in the surface few inches to impart a gray color to the material. The surface is nearly flat and drainage is poor. A small percentage of the type is used for trucking.

The Portsmouth fine sand is a dark-gray to black fine sand, usually rich in organic matter. It occupies flat depressions of poor natural drainage. The typical vegetation is pine, wire grass, and palmetto, but a phase is mapped in which the natural vegetation is a heavy hammock of cabbage palmetto, myrtle, wild fig, and bay. In some areas the limestone is encountered within the 3-foot vertical section, and such areas are mapped as a limestone-substratum phase. The Portsmouth fine sand when drained is considered a good trucking soil and a fair soil for orange and grapefruit groves. The hammock and limestone-substratum phases are considered more productive than the typical soil.

The Dade fine sand is a light-gray to white fine quartz sand, underlain within 3 feet of the surface by limestone. It has a level to ridgy topography, usually higher than the surrounding country. Only a very small part of the type is under cultivation. A hammock phase is mapped which differs from the typical soil in supporting a heavy hammock growth of live oak and other trees. The surface material is darker colored and the subsoil browner than is the typical Dade fine sand. This phase is highly prized for citrus fruit growing.

The Parkwood silt loam to a depth of 3 feet or more is a brownish-gray to gray silt loam consisting chiefly of calcium carbonate. It occupies depressions near the coast and the surface is flat and poorly drained. Some of it is subject to tidal overflow. Such areas are separated as the salt water phase. A shallow phase is mapped, comprising areas where the gray silt loam is underlain at 8 to 30 inches below the surface by muck, peat, or fine sand. The Parkwood silt loam where sufficiently drained by ditching has been used for the growing of truck crops, chiefly tomatoes.

The cumulose soils consist chiefly of organic material in various stages of disintegration and decay, with an admixture of varying quantities of extraneous inorganic matter. The cumulose soils are classified as Muck, Peaty muck, and Peat.

Muck is black, heavy, and somewhat plastic. It consists of well-decayed vegetable matter mixed with varying quantities of inorganic material. The loss on combustion of typical samples averages about 50 per cent and is less than 65 per cent. A shallow phase is

mapped, where the muck is less than 36 inches deep and overlies sand or limestone. Muck has been used for the growing of truck crops and bananas.

Peaty muck is dark-brown to black, decayed organic material with sufficient mineral matter to lower the loss on combustion to 65 to 84 per cent of the weight of the oven-dried sample. A phase is mapped which is subject to overflow by salt water.

Peat consists almost entirely of organic material in various stages of disintegration and decay, with an ash content varying from 6 to 16 per cent. Two distinct classes of Peat are recognized, Brown fibrous peat and Black nonfibrous peat. Phases are separated on the basis of depth of organic material, differences in underlying substratum, and character of vegetation. Sandy phases of the Brown fibrous peat are recognized, in which there is sufficient quartz sand to raise the ash content to 16 per cent or more. The Peat, chiefly of the nonfibrous sort, is used to some extent for trucking purposes.

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U. S. DEPT. OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP

FLORIDA
FORT LAUDERDALE SHEET

LAKE OKEECHOBEE

HILLSBORO CANAL

LEGEND

- St. Lucie fine sand — Sf
- Flat phase — Sf
- Poorly drained phase — W
- Plummer fine sand — Pl
- Portsmouth fine sand — P
- Hammock phase — H
- Limestone substratum phase — L
- Dade fine sand — D
- Hammock phase — D
- Parkwood silt loam — Pk
- Shallow phase — Pk
- Salt water phase — Pk
- Palm Beach sand — Pb
- Peaty muck — Pm
- Salt water phase — Pm
- Brown fibrous peat
  - Deep over limestone — Bfp
  - Deep over sand — Bfp
  - Shallow over sand — Bfp
  - Sandy phase Deep over limestone — Bfp
  - Sandy phase Deep over sand — Bfp
  - Sandy phase Over sand (12 to 36 inches) — Bfp
  - Sandy phase Over sand (2 to 12 inches) — Bfp
- Black nonfibrous peat
  - Deep over sand — Bp
  - Shallow over sand — Bp
  - Deep over limestone — Bp
  - Timbered phase — Bp
  - Cypress Island phase — Bp
- Muck — M
  - Shallow phase — M
- Swampy areas
- 66 — Mile post
- 29 — Location of boring and sample number

PALM BEACH CO.
DADE CO.
APPROXIMATE BOUNDARY

FORT LAUDERDALE
Lake View
Lake Mabel
Dania
ATLANTIC OCEAN

W. Edward Hearn, Inspector Southern Division
Soils surveyed by Mark Baldwin and H. W. Hawker
Chemical work by Carl F. Miller

Scale 1 inch=1 mile
1 ½ 0 1 2 3 4 Miles

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Field Operations
Bureau of Soils
1915